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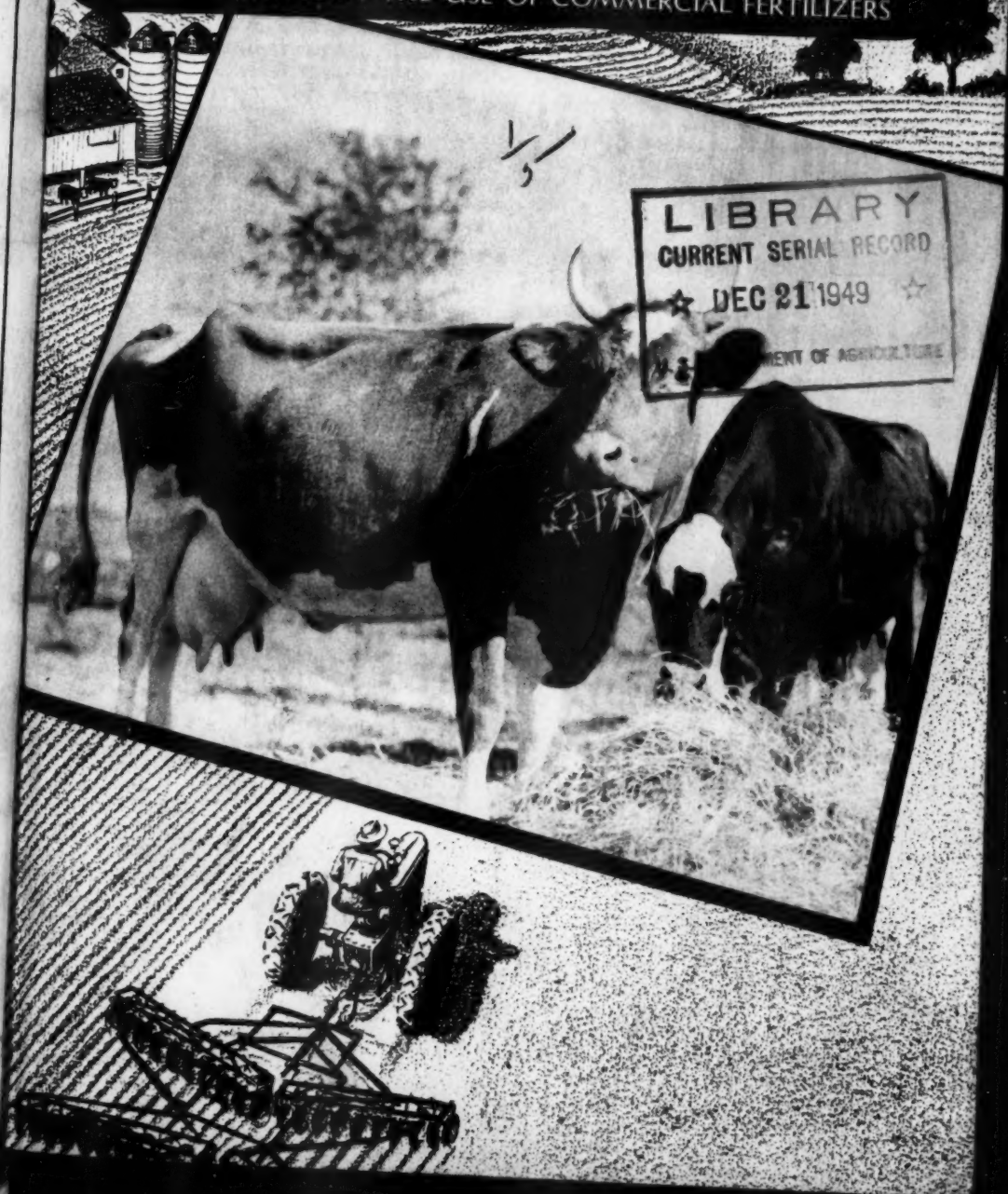

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VOL. 1, NUMBER 5 DECEMBER, 1949

THE ORGANIC FARMER

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Published monthly by ORGANIC GARDENING. Publication, Executive, Editorial, Subscription and Advertising Offices: 6th and Minor Streets, Emmaus, Pa. Subscription Rates, United States and Possessions, One Year $3.00, Two Years $5.00. Three Years $6.00. Entered as second class matter at the Post Office at Emmaus, Pa. under the Act of March 3, 1879.

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From Readers . . .

Canadian Rancher Uses Mulches

Dear Sir:

Your publication is, I believe, one of the truly worthwhile magazines in the agricultural field. Its objective is one of great constructiveness, and is a movement which should have long ago been started in this continent.

We are just opening up a new 18 acre ranch, and will be operating entirely with organic fertilizers. There is considerable evidence to show that surface mulching on ground crops is very good. In the event that we do not have sufficient compost available, would it not be better to disk this mulch into the ground prior to planting, than to supply it as a surface mulch during the growing period?

The interior valleys along the Pacific coast, in the dry belt, run mostly slightly alkaline. The decomposition of organic matter there is quite rapid. We have been using the new portable sprinkling systems, and with the resulting efficiency in irrigation have been able to build up black surface soil in the orchards through heavy cover cropping.

Please accept our best wishes for your continued progress and prosperity.

B. I. Hove,
Grand Forks, B. C.

Ed. *It is best to disk in a mulch a month or two before planting, to allow the organic matter to decompose into compost. Raw organic matter in the soil usually takes out nitrogen. However, a mulch on top of the soil is satisfactory in many cases.*

Sold on Organic Farming

Dear Sir:

I can remember three great days in my life. First, when providence made it possible for me to acquire this 43 acre farm five years ago, second, when I read articles on Faulkner's "Plowman's Folly" and third, when I received literature from you people. I can see the tragedy of orthodox farming today and the plight it is bringing to agriculture. I'm just sold 100 per cent on Organic Farming.

Gilbert C. Curtis,
Seneca Falls, N. Y.

How To Utilize Wheat Straw Stacks

Dear Sir:

On my farm there are two large wheat straw stacks, each containing approximately 15 tons. I have no livestock to make manure and since I dis-

like the idea of burning the straw as is done quite commonly hereabouts, I have been trying to find a way to hasten decomposition without the labor of turning it over.

Any procedure or suggestions that you will make will be greatly appreciated.

Preston T. Higley,
Metamora, Michigan.

Ed. *It is almost essential that straw be mixed with some kind of manure or other organic matter to speed decomposition. Poultry manure can be purchased cheaply. Corn cobs may be had for the asking, and, if ground, will quickly improve the quality of decomposed straw. Running the straw through an ensilage cutter will also enable it to turn into compost much more quickly.*

How To Stop Gully Erosion

Dear Sir:

When I purchased my present farm, consisting of 87 acres and the usual farm buildings, the land was badly run down and eroded. In pursuing traditional farming methods I made the land somewhat worse until I had gullies in places that would hold two or three automobiles easily.

Finally the conditions got so bad that I realized I would have to do something about them or cease cultivation. In fast, I did both!

Upon giving some thought to the matter, I came to the realization that the poorer the ground got the more it washed, and the more it washed the poorer it got. Since the ground had considerable slope, I could not stop the water running down the hill very easily, but I could make the ground richer. From this conclusion our present plan envolved.

I began spreading manure around the area which drained into each gulley, with the thought that where the most water flowed, the most manure would also flow. Also, each day the hay seed which fell at the base of our hay drop in the barn was swept up and scattered over the same areas as well as in the gullies themselves.

Although the gullies reached down into a layer of red shale and in some cases even to bed rock, in a surprisingly short time weeds and grasses began to grow in the bottoms of the gullies. As soon as this occurred, the vegetation caught the soil moving through the gullies and held it. Since this soil was topsoil and the manure and fertilizer which had been spread, it was quite rich and in a year the vegetation in the gullies was growing rankly.

In some of the worst cases and when we had cuttings of weeds and brush to dispose of, the cuttings were put in the gullies to slow up the water. In all cases our erosional problems have ended.

I no longer do any plowing what ever but simple cut hay, feed it to my animals and return the manure and bedding to the soil. Our hay is getting better every year and the animals seem to do very well on it. I use no grain, as my theory was that if the great herds of western sheep and cattle thrived on grass, there was no reason why mine couldn't. It has worked quite well for the past ten years.

Frank S. Flaherty
Jacksonwald, Pa.

Part-Time Farmer Requests Information

Dear Sir:

There must be millons of people like me who have a small plot of ground of approximately five acres. We know nothing about taking care of this land, and we have different

problems than those who possess larger tracts of land.

It is impossible to put in thousands of dollars worth of equipment. Why don't you have someone write articles on things such as the following in regards to small acreage: the Rototiller, methods of reducing weeds, tilling and the planting of cover grases.

John R. Wenrich

Ed. *Future issues of the Organic Farmer will contain more articles slanted toward the part-time farmer.*

In Defense of Ladino Clover

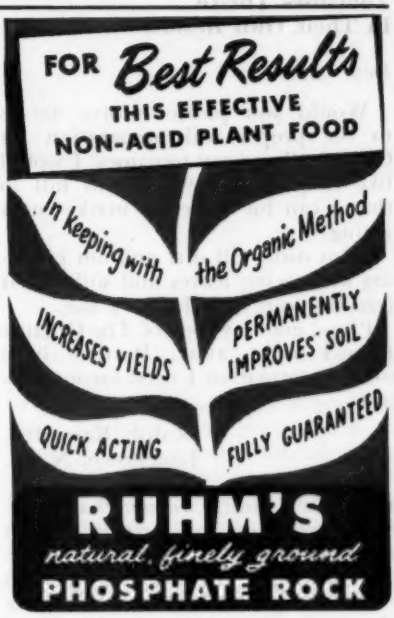
Dear Sir:

In the article "An Experiment in Plowless Farming" in the October issue of The Organic Farmer, John Moyer criticizes ladino clover as not being a particularly good soil builder. In this part of the world ladino is not expected to be a good soil builder. Its value lies in its nourishing quality, the fondness of cattle for it, its abundant growth and its amazing comeback after grazing.

Its an outstanding crop and anyone reading that article might think it didn't amount to much.

J. Hopkins Smith, Jr.
Portland, Maine

Ed. *As Reader Smith claims, ladino is not a partlcularly good soil builder. However, John Moyer is enthusiastic about its qualities as a pasture crop.*



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Tomatoes Thrive In Their Own Residues

Dear Sir:

Would you please inform me as to the proper soil preparation for Organically grown tomatoes. I would like to prepare my soil this fall so that I can hit the early market next spring.

I am using fill dirt and am planning on mixing leaves and soil. What fertilizer can and should I use.

Please mail my copy of The Organic Farmer right away, It may have some imformation I need for my project.

Ralph Kanouff
Jamestown, N. Y.

Ed. *It is definitly known that tomatoes thrive in soil fertilized with their own residues. Perhaps someone near you grows tomatoes on a commerical scale and doesn't realize the "by-product" value of the vines. Put the tomato vines as a mulch where you plan to grow tomatoes next year and you will surely have a fine crop.*

Cull Apples Can Be Fed To Dairy Cows

Apples are greatly relished by cows and make a good feed when properly used in moderate amounts. Cooperative experiments between the dairy department and the horticultural department at the Ohio Agricultural Experiment Station indicate that the dry matter in apples has a feeding value equal to that of corn silage.

However, because apples contain approximately twice as much moisture as corn silage, their value on the ton basis is approximately one-half that of corn silage. The cows ate a little over 30 pounds of the apples a day, which had been broken by running them through a root cutter.

There is more or less common belief that apples are not good for cows and will cause them to "dry up". In many cases where such unfavorable results have occurred, the trouble has been traced to overfeeding of this palatable succulent feed.

In some cases, this has been caused by the unfavorable results when cows have broken into orchards or have had access to quantities of apples and have eaten more than was good for them. Some animals have even died from choking caused by an apple becoming lodged in their throat, but this does not justify condemning the use of apples.

Ladino Surpasses Alfalfa As Hog Pasture

You can put faster and cheaper gains on pigs by using Ladino pasture rather than alfalfa.

This was the conclusion of Purdue University swine men after an 84-day trial. Fifty pigs which were pastured on Ladino with no supplement gained 1.41 pounds each day compared with 1.26 pounds for those on alfalfa pasture with no supplement.

Not only were the gains on Ladino pasture faster than alfalfa but 21 pounds *less* feed were required to put on 100 pounds of gain.

These fast and economical gains apparently result from the fact that hogs like Ladino better than alfalfa. Illinois farmers have found that pigs will prefer Ladino every time when given a choice of the two pasture crops.

The Purdue tests also showed a big saving in protein supplement when Ladino pasture was used.

Editorial

ABOUT eight years ago I purchased what is now the Organic Experimental Farm. A sorry 63 acres it was. The tenant barely existed on it. The Government would not make a loan on it because, as the investigator later told me, he could not see how anyone could make enough on it to live and to pay off the loan. There were many dead chickens laying under the corn cribs (it was winter time). In the two small cribs lay the answer to the deaths and the disease with which this farmer's flock was infected. It was the worst mess of corn I had ever seen—small, gnarled, diseased, grown on an infertile farm. This farmer had about ten cows and two horses, so he had manure, but he *did* use chemical fertilizers. Some tenant farmers have been known to sell the manure, figuring that they could farm exclusively with chemicals, as the owner usually pays the cost of the chemical fertilizers. I do not say that that was so in this case, but judging by the appearance of the corn, it is possible.

Well, we started in 1941 with the organic method, which in those days meant using only compost. At that time I did not know about ground phosphate rock and other rock fertilizers. We did not do dairying. Our manure came from a herd of steers which we were fattening. The value of the organic method was that to make compost out of this manure by the Sir Albert Howard method, we had to find three times as much green matter as manure to make it with. This meant salvaging valuable organic matter which ordinarily went to waste.

We always managed to get enough other organic matter to go with the manure. Thus we kept down the weeds growing near the barn and hedgerows. In the fall we brought in many loads of leaves from the highways and the woods. Of all green matter, the leaf is unusually valuable, because trees send down their roots sometimes 25 feet and bring up valuable minerals from unexhausted levels that come into the leaves. We got many loads of weeds from neighboring fields owned by city people who were not farming them, highway cuttings, corn cobs obtained free from mills, apple pomace from cider mills, garbage rescued before it reached the city incinerator, spoiled hay, etc. We had the will and the enthusiasm and never lacked for needed green matter with which to make compost. I realized too that we were saving money by not having to buy chemical fertilizers.

At this time I came across a booklet written by George Sheffield Oliver who bred earthworms for planting into soil and also for feeding to chickens. I saw the possibility of feeding earthworms to chickens during the winter in order to keep them healthy at a time when we could not feed them fresh green plant matter. I sent for a few hundred of these worms which are the brantling type of small red manure worm and began to breed them.

In this first or second year when I still had to purchase mash for the chickens, there was disease present in the flock. I remember once that we were confronted with three paralyzed chickens. They were lying in a corner

and would not eat. An ordinary poultryman does away with chickens that are in this condition. I recalled receiving a letter from one of the readers of our magazine who described how he cured paralyzed chickens by feeding them live earthworms. We decided to do the same thing. When we put an earthworm against their mouths they snapped it up. In three days time those chickens were running around, clear-eyed, as healthy as any of the other chickens, and it was done by merely feeding them earthworms, with no medicine of any kind whatever.

To me this is a miracle. God made an earthworm and a chicken for each other, to the chicken's benefit. In nature the wild chicken roamed about eating grass and worms. It remained healthy on such a diet. Today, under artificial conditions of feeding, there are all kinds of diseases in commercial flocks, including cancer. I believe there is something within an earthworm which, if it can be isolated, can be used to cure disease in human beings, perhaps in a more spectacular manner than penicillin. Here certainly is something for the medical profession to get busy with.

The next step in my adventure in chicken raising was to work out a dropping pit under the roosts. Thus the chickens lived in a clean orderless atmosphere which is part of the story in keeping them healthy.

But the main reason for the wonderful record of health in our chickens which we have chalked up is the food for them which we raise on our own farm, without chemical fertilizers, but with plenty of organic matter and minerals. After three or four years of working the farm by this method, the quality of our crops has increased to such an extent that it has enabled our chickens to become free of disease. These crops we know, by test, have a higher vitamin content than those raised with chemical fertilizers. We, of course, see to it that our birds have access to grass and are not crowded. The litter we use is ground-up corn cobs.

Today, our chickens are so healthy that we do not have one sick chicken. There are absolutely no deaths from disease. It must be seen to be believed. I would say that 70% of the equation is the food for them which we grow on our own farm. The only thing we buy is meat-scraps and I am now thinking of cutting that out, feeding in its place a little more soybeans.

Peanuts

Peanuts, ground up with the shell, could be a wonderful protein food for chickens, because it is about the only non-meat food that contains all the known amino-acids (protein). Experimentally, we have grown peanuts on our farm, which is in the Philadelphia latitude, and had a fair yield. We expect to grow them on a bigger scale next year. If you are interested, check with your seed-house for a variety to fit your climate.

A very remarkable thing that has been occurring in our chicken house suddenly dawned upon me several years ago. We get thousands of visitors to our farm each year, many of whom are poultry people. Many flock owners will permit no visitors to enter their chicken houses for fear that on the bottom of their shoes they may be harboring disease organisms. In our case for five or six years visitors have come in with no harm to our chickens. When I take a visitor through our chicken house and I know that he is a poultryman I will now ask him to rub his feet vigorously in the chicken litter with full confidence that our chickens have built up a resistance to disease by the healthy food they have been eating. Recently there were four classes of 20 farmers each that went through the chicken house and when I asked them to rub their feet in the litter, and explained our method of growing crops, I made many converts.

To anyone who has raised poultry, a trip to our farm is a revelation. When visitors see the faces, the feathers and the combs of our chickens they are most impressed. It has been

a pleasure for me to watch their reactions and to hear their extravagant praises. And coming from old-time poultry people it has a double effect. When you think of the large departments in the Agricultural experiment stations devoted to the pathology or diseases of poultry, when you see the thousand page volumes devoted to the same purpose, and then see our place, it is something to wonder about. I do not have to waste time studying disease. I can devote my time to more positive endeavors. We do not have to vaccinate our chickens or feed them medicines or vitamin preparations. It must be seen to be appreciated.

There has been a change in the year 1949 which tremendously simplified the organic method. From now on we will make very little compost. The extra organic matter we are able to obtain we will disc right into the soil. This new method has been described in past articles and will be the subject of future articles in these columns.

Miscellany

THE bill which was offered in Congress by Representative Frank B. Keefe of Wisconsin, to investigate the use of chemical fertilizers and poison preservatives in food and which was referred to the rules committee, is still there. For some reason Chairman Sabath of the rules committee decided to rewrite the bill and to offer it in his own name, along the lines suggested by Congressman Keefe's resolution.

Under date of October 3, 1949, Representative Keefe writes me:

Dear Mr. Rodale:

"Chairman Sabath has offered a resolution providing for an investigation along the lines suggested in my resolution. I assume that this is for the purpose of putting it in safe Democratic hands in the event the Rules Committee grants a rule for this resolution.

"I appeared before the Rules Committee and vigorously presented our position, but up to date no action has been taken.

"I appreciate your continued interest."

Here is a memorandum, dated Sept. 17, 1949, that came into this office from Washington, D. C.:

"Seven Senators, six Democrats, one Republican, have joined to introduce a resolution calling for investigation of monopolistic practices in the fertilizer industry. The Democrats are Senators Taylor, Murray, Withers, Gillette, Johnston (So. Car.), Sparkman and Magnuson. Senator Langer is the Republican.

"The resolution hits hardest at the potash industry, which the Senators accuse of growing on government aid but which they say is controlled by a few companies 'who have restricted production in order to make extraordinary profits.' The resolution provides $25,000 to 'conduct an investi-

gation of the nature and extent of monopolistic practices in the fertilizer industry, including the manufacture and distribution of potash, phosphate and nitrogen.'"

Things are stirring!

Problems

Some organiculturists are up against it. The following excerpt from a letter will show you what I mean:

Gentlemen:

"You will please find check enclosed in the amount of seven dollars ($7.00) for which please send me the books, *The Pruning Book,* and *Nutrition and The Soil.*

"Actually I am ordering *The Pruning Book* for Mr. X, my neighbor, who is also an avid *Organic Gardening* and *Organic Farming* fan. I believe Mr. X would send you a blanket order for every book you have for sale, including a standing order for every new one, so Mrs. X has a book rationing plan which she strictly enforces. To get around it, Mr. X, just having passed another birthday anniversary, suggested to me that I order this *Pruning Book* and present to him as a birthday present—and he would pay me on the side for same! I thought perhaps this little incident would prove to be a little interesting sidelight showing to what limits some people will go to satisfy their appetite for more knowledge of farming and gardening . . . especially organic and organic recommended ways."

Sugar Factory

I recently went to a sugar refinery to see the process by which the raw sugar, coming in from Cuba, is refined. The air is so thoroughly saturated with sugar that it goes right through you. I had lunch in the company cafeteria. Next to me sat one of the refinery workers who was putting sugar in his coffee. I counted the spoonfuls as he put them in. One, two, three, four, five, you would not believe it unless you saw it—six teaspoonfuls of sugar. If this does not remind one of the use of chemical fertilizers I do not know what would.

That man is so saturated with sugar, his system is so used to it, that to get any effect, he needs more and more of it, just as the land does when chemicals are used. As the years go by, to keep up the yields, the land needs more and more chemical fertilizers. The sugar itself reminds one of a chemical fertilizer. It is refined and refined until it is absolutely devoid of any minerals. If you want to be really healthy cut all white sugar out of your diet. Obtain some sweets through fruits, honey, molasses, etc.

Crop Insurance

Now they are talking of insuring crop yields. In this year of drought, organiculturists have discovered that if the soil contains sufficient organic matter, they need not fear depressed yields. This year we realized 34 bushels of wheat to the acre on our farm, whereas the average yield around here was about sixteen. And here is something! In the previous year we sent some of our wheat, and some from a neighboring farm that puts the accent on chemical fertilizers, to the Pease Laboratories, New York City, for a vitamin test. Our wheat contained 40% more vitamin B_1. We have far greater yields and far higher vitamin content in our organically produced crops.

Pushing Cows

Here is an interesting item from the Los Angeles Examiner of Sept. 8, 1949:

"Speaking before Farm Bureau members at the Santa Barbara dairymen's meeting, Dr. Leslie M. Hurt, head of the Los Angeles County livestock department, told his hearers of a newly discovered non-contagious bovine disease.

"The ailment is known as 'acetonemia.' It affects only cows of high-producing herds and is believed to be the direct result of heavy protein feeding in the effort to push the animals

beyond their capacity to produce milk.

"Symptoms are similar to those of 'milk fever.' The remedy lies in supplemental feeding of trace elements, vitamins and a lowered protein ratio.

"Milk production levels have been and doubtless still will be raised by breeding higher productive capacity into the cows. Apparently no animal can be urged safely beyond levels of which she is inherently capable."

These agricultural scientists are overlooking two important items in the consideration of the diseases of the cow, and if they do not soon wake up something disastrous is going to happen. First they must improve the soil in which the cow's food is raised, by putting more organic matter into it, and the mild rock fertilizers like phosphate rock that have the rare trace mineral elements. Secondly they must reverse the process of enlarging the size of the cow's udders—that is breeding for high production. In studying the pictures of cows on old Babylonian monuments one does not see any udders. The teats of the cow look like those of a female horse or dog. They are there but are practically invisible. Do you know that the size of a cow's udder today is, on the average, ten times the size of a cow's udder in the time of George Washington? Such tampering with a delicate function which takes in the formation of sex hormones in the cow's milk may be fraught with the gravest of dangers to the drinkers thereof. Is the derangement of the hormone content in milk one of the many things that are at the bottom of cancer? I do not know. Do the cow breeders know what they are doing, or where they are going? Are the blowing up a big balloon that will someday burst? Already there are on the market girdles that hold up the cow's udders because in many cases there have been breakdowns, rupturing of the udder due to its heavy weight.

Bossy, what are they doing to you? Society for the Prevention of Cruelty to Animals, please stay the hand of the cow breeder.

Is There Enough Green Matter?

Every once in a while people who are not friendly to the organic method, or over conservative ones in our own group, will say, where will we get enough green matter for fertilizer use. From time to time we come across news items which show what sources there are. The following item was sent in to me recently without the name of the newspaper:

"As a part of the country's battle against hyacinths in lakes and streams, almost the entire area of Lake Thonotosassa was sprayed from a helicopter Saturday afternoon with a deadly fumigant which kills the plants and causes them to sink, where they disintegrate.

"By Tuesday, great masses of the pesky plants had begun to turn brown, but experience has shown that at least 40 days is required before they disappear altogether.

"The spraying was watched with interest by members of the East Hillsborough Fish & Game club, since it is one of their projects. The hyacinth war is financed in Hillsborough by the additional $1 on fishing licenses sold in this county."

Couldn't all this green matter be harvested by special machinery and plowed into the top-soil of the neighboring farm lands? How many hundreds of thousands of tons of water hyacinth are destroyed each year by the profligate hand of man, the waster? Some day we are going to wake up and discover the sad implications of these errorful ways.

Baltimore Sewage

Baltimore announces a plan to make their sewage sludge more usable. They are putting in a drying plant. Ordinary sludge is 50% water. The Baltimore product will carry only 2% and will be pulverized. It will be sold at from $6 to $8 a ton which will only give it back its costs. We do not recommend sludge for food crops because of the poisons from industrial wastes that are sent into city sewer systems, including the washings from

gasoline stations. Use it for lawns and shrubbery.

Another Example

The old-established *Rural New Yorker,* even though it carries many advertisements of chemical fertilizer manufacturers, printed a letter (Sept. 3, 1949) which shows that it is open-minded. Here is part of it:

"Though we expected the dog days would bring rain and a heavy hay crop (farmers cut half in the early hot days), we in the Green Mountains watched the stubble turn sere in the heat and drought. Gardens have suffered but not as much as the hayland, perhaps because of a dust mulch. Perennials hung their leaves loose and limp, and buds blighted if they formed at all.

"The organic gardeners surely have had their innings this year, as the humus holds the moisture far better than chemical fertilizers. It is safe to say the compost heaps will be bigger and better than ever this Fall."

Still Another Example

Here is a condensation from a news item that appeared in *The Hartford Courant,* Sept. 7, 1949:

"Goshen, Sept. 6. — (Special.) — George Riddle, mathematics professor at Columbia University and casual gardener at his summer home here, won top prize at Goshen Fair this year for the largest and best exhibit of vegetables.

"That he would win was almost a mathematical certainty, when one looks back over recent years. He has been creeping up on that top prize in reverse mathematical progression. Two years ago he won third prize. Last year he won second prize. Ergo, this year, first prize.

"They bought their place here about 11 years ago, to get away from the big city in the summertime and each year, they admit, adds something to their pleasure and satisfaction over the purchase.

"They started a home garden in casual fashion, because they had the land. Gradually the activity became more and more interesting, a pleasant avocation. Today, both are adept at organic gardening, using clippings from a big lawn to mulch and feed the garden soil. They no longer use any commercial fertilizer."

Merry Christmas.

—J. I. RODALE.

Cannery Wastes

Cannery wastes consist of many different materials such as plant matter, citrus wastes, apple pomace, tomato wastes, etc. All cannery wastes are useful for making compost. If the material is very fine, it may be wise to add some stalky matter to it in order to get better aeration and to prevent too solid packing that would inhibit bacterial action. If the material is already in the process of decay, perhaps slimy and smelly, it contains bacteria in the process of action; if the process has gone on for considerable time in the open, nitrogen and potash may already have been leached out. To get first rate compost, a somewhat more liberal amount of manure may be necessary in the final compost making.

Soil Acidity Is Beneficial

By Dr. William A. Albrecht

University of Missouri

Reprinted from *The Southern Florist and Nurseryman*

ONLY recently have we come to appreciate the services by soil acidity in mobilizing — making available — many of the nutrients in the rocks and minerals of the soil. When we learned that soils are less productive in giving us legumes and other protein-rich forages, according as they become more acid either naturally or under our cultivation, we came to the conclusion that soil acidity is the cause of this trouble. We now know that a plant puts acid into the soil in exchange for the nutrients it gets. It is that same acid held on the clay that weathers the rock fragments and serves to pass their nutrients on to the clay, and from there on to the plant.

The coming into the soil of excessive acidity is merely the reciprocal of the going out of the fertility. Nature's process of feeding the plants, and thereby the animals and us, is one of putting acidity into the soil from the plant roots in order to break out of the rocks what nutrients they contain for nourishment of all the different life forms. Soil acidity always has been the agency in the soil to keep the assembly lines providing the available fertility for crop nutrition, which in turn is nutrition for all higher life.

Limestone Becomes a Calcium Fertilizer on Acid Soils

When we put lime rock on the soil as a fertilizer supplying calcium to our legume crops, we know full well that this rock reacts with the acid-clay of the soil. The acid goes from the clay to the lime rock which, being calcium carbonate, breaks down to give carbonic acid while the calcium is absorbed or taken over by the clay. While the calcium goes on to the clay to be available there for the plants, the carbonic acid decomposes into water and carbon dioxide as gas. Since this gas escapes from the soil, this escape takes away the acid, or, as we say, "it makes the soil neutral." The benefit to the legume crop from the application of this lime rock to the soil does not rest in the removal of this soil acidity. Rather, it rests in the exchanging of calcium as a nutrient to the clay which was holding the acidity or hydrogen, a chemical element that is not of direct nutritional service.

Various Other Rocks as Well as Lime Rock Are Fertilizers on Acid Soils

Soil acidity has been breaking potash rocks down chemically too. During all these past years the potash feldspars have been undergoing weathering attacks by soil acidity. On this rock the acid clay carries out its weathering effects in the same way as it does for lime rock, except that it trades acid to the feldspar and takes potassium unto itself in exchange. Magnesium rock, as we have it in dolomitic limestone, is also broken down by the acid clay. By this same process the clay becomes stocked with magnesium. This is then more readily exchangeable and available to the plant from the clay than it would be if the plant root were in direct contact with the rock fragment itself. By exactly the same mechanism we can expect phosphate rock to be made available for the plant's use.

It is in these processes by which the

acidity of the soil is beneficial. If the soil contains the two colloids, clay and humus, which can hold acidity, and then if that soil has scattered through it fragments of lime rock, of magnesium rock, of potassium rock, of phosphate rock, or in fact of any rock with nutrients, it is the soil acidity that mobilzes to the clay the calcium, the magnesium, the potassium, the phosphorus, or all the other nutrients respectively, for rapid use by the plants. This is Nature's process of providing plant nutrients on the clay of the soil in available form. By it Nature has stocked our moderately acid soils with fertility. It was that condition of our virgin soils that spelled our prosperity. We need to go back and study the soil in order to learn how we can gear the lime rock into our acid soils so it will stock our soils with calcium and still not remove all the acidity needed to make the other nutrients available in other rocks, of which some are giving phosphorus, some giving potassium, and some giving one or more of all the other nutrients in whatever rock form Nature has them.

Acidity is a Slow Mobilizer of Nutrients Contained in the Minerals

Of course, Nature's processes do not demonstrate high speed. It takes six months or more for limestone to stock the clay with enough calcium to feed our legumes. It takes longer for others. Consequently, if phosphate rock is slow in demonstrating its effects on the crop, we need not be alarmed. It certainly will not be very active in soils that are not acid. In our western soils that have considerable free lime rock mixed thorughout them, the plants suffer from phosphate deficiencies. Rock phosphate may not be so efficient there. Dr. Hutton of South Dakota pointed out that phosphorus delivery to the crop was the major problem on these highly calcareous, or these distinctly neutral soils. It is on soils of that reaction that cattle have been bone-chewers. Apparently they are going to that extreme behavior in order to get their phosphorus, which the forages as feeds on the soils there fail to provide. So when the soils are not acid we may expect shortages of some fertility elements like phosphorus, for example, in the plants and even in the animals. It is on the acid soils where most of our population has always fed itself, suggesting that it is on those acid soils where there is much more speed in making the fertility active and available from out of the reserve minerals.

Phosphorus Deficiencies in the Soil Suggest Possible Health Troubles

That human health may be related to the deficiencies in the soil has come to be more than mere speculation when animal troubles are localizing themselves more and more according to soil fertility deficiencies. If one looks at the map of poliomyelitis in 1946, for example, it is significant that this health trouble was most severe in those states where the less acid soils give deficiencies in phosphorus for the plants and animals. It is all the more significant when we remind ourselves of the fact that the brain and nerve tissues—most seriously affected by "polio"—represent high concentrations of phosphorus. Whether there is any casual connection between this human affliction and these non-acid soils because phosphorus availability there is low is a question that remains for research to answer.

There are also other nutrients in addition to phosphorus that are not mobilized effectively unless the soils are acid. These include iron, manganese and boron. Perhaps these or some others not yet appreciated are causally connected with this baffling disease. Other diseases may be in a similar category. When we see the inroads by brucellosis on our herds of cattle and hogs, and when undulant fever, passed seemingly from these, is becoming more common, there is decided encouragement to theorize and do some research on the belief that we need acid soils, and need to gear more mineral fertility through the acid assembly lines of our soils.

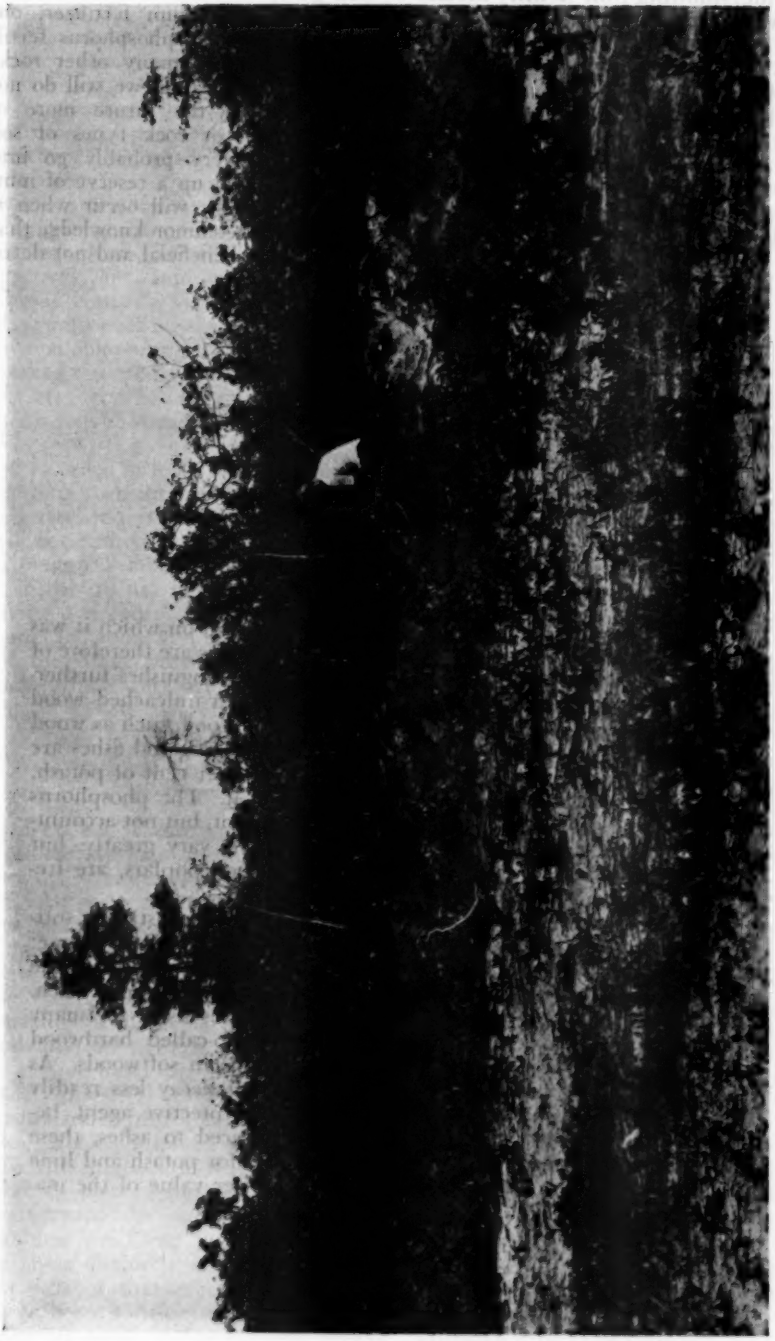
Understanding Soil Acidity Means Appreciating the Deficiency of Soil Fertility

We have used lime rock, phosphate rock, and green sand as potassium rock, in both the experimental work in the laboratory and in the field trials, to convince ourselves that the plant nutrients within these are made available to plants by the acidity of the soils. Possibly as we come to appreciate the benefits of soil acidity we shall no longer fight it with carbonates, but shall guard it and use it to treat our lime rock as calcium fertilizer, our phosphate rock as phosphorus fertilizer, and possibly many other rocks whose fertilizer values we still do not appreciate. In the future more of these mineral or rock types of soil builders will very probably go into the soil to build up a reserve of minerals there. This will occur when it becomes more common knowledge that soil acidity is beneficial and not detrimental.

Wood Ashes

Depending on the variety of tree and kind of soil on which it was grown, wood is of varying composition and wood ashes are therefore of different fertilizer value. The fertilizer industry distinguishes furthermore according to the history of treatment between unleached wood ashes, leached wood ashes, and ashes from leached wood, such as wood from which tannin or dyes have been extracted. Hardwood ashes are available in the market and contain from 1 to 10 per cent of potash. If unleached, they contain at least 4 per cent of it. The phosphorus content is usually about 1.0 to 1.5 or even 2.0 per cent, but not accounted for in the fertilizer trade. The trace minerals vary greatly, but plants grown in moist places, such as alders, ashes, poplars, are frequently richer in minerals than trees from dry land .

Many readers have requested answers as to what constitutes softwood and hardwood trees. The terms are those of common usage; softwood trees are evergreen trees, such as pines, firs, spruces, while hardwood trees are the deciduous trees, such as oak, beech, birch. These terms are rather illogical, though widely thus used, for many softwoods have much harder wood than many so-called hardwood trees, while many so-called hardwoods are softer than softwoods. As a rule, softwoods contain resins and terpenes and decay less readily than the hardwoods which contain tannins as a protective agent, besides all kinds of oils, milksaps, etc. When reduced to ashes, these substances are no longer present, and the analysis for potash and lime (calcium) is an adequate indication of the fertilizer value of the material.



Sandy soil covered with brush was converted by Gericke into productive fields.

The Story of A Staten Island

Organic Farm

By Alden Stahr

IT'S hard to say which was the more astonishing, to find an organic farm inside the New York City limits or to discover a graduate of Rutgers Agricultural College who is an organic farmer. I found both together at the Organic Farm of Richard Gericke on Staten Island, which is the Richmond Borough of New York City.

Actually, it isn't too surprising to find a farm in New York City as there are over two hundred of them, and Staten Island is mostly woods and fields, but the people of the world's biggest city find the produce of an organic farm so much better than the food they can buy elsewhere that they come long distances just to buy fresh organic vegetables from Gericke. Flavor and quality-minded customers come, too, from Long Island and New Jersey and others buy by mail from as far away as California and Florida, two of our greatest food-producing states. What would their Chambers of Commerce say about that?

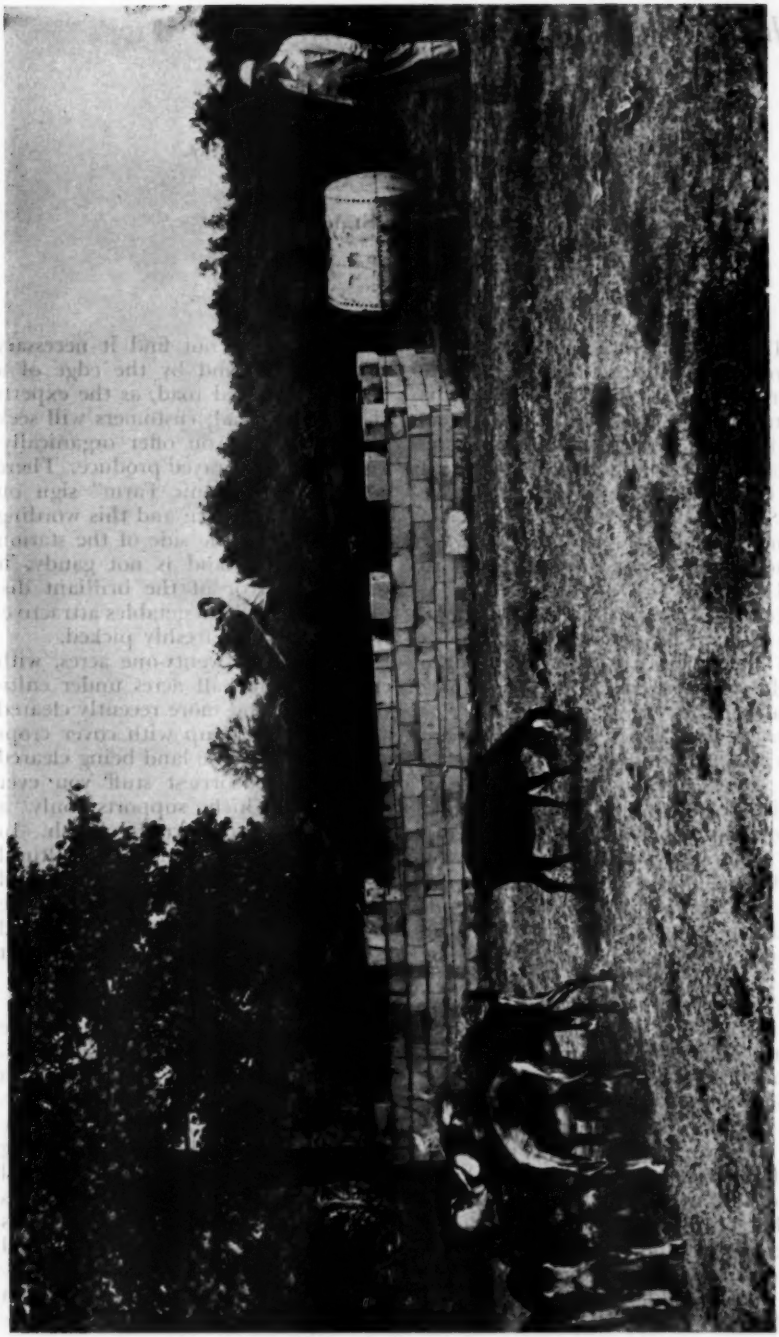
When we went over to Staten Island to visit my brother, he drove us over to the Gericke Organic Farm on Arthur Hill Road and we could see at once that the farm was in a state of expansion. Bulldozer and tractor had been working to enlarge the fields available for truck farming and we could tell even before Gericke told us that business is so good that he is forced to expand. A large sign "Organic Farm" is at the edge of the road, but the vegetable stand is built into the barn.

Gericke does not find it necessary to have his stand by the edge of a heavily trafficked road, as the experts claim is essential; customers will seek you out when you offer organically-grown and unsprayed produce. There is another "Organic Farm" sign on the side of the barn and this wording is repeated on the side of the station wagon. The stand is not gaudy; it retires in favor of the brilliant display of beautiful vegetables attractively arranged and freshly picked.

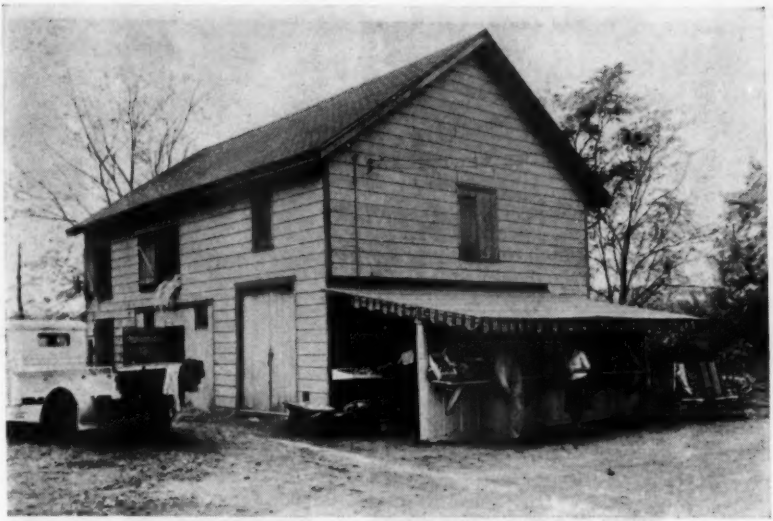
Gericke has twenty-one acres, with eight and one-half acres under cultivation now and more recently cleared and being built up with cover crops and compost. The land being cleared is about the sorriest stuff you ever saw—sand which supports only a meager stand of scrubby brush. In fact, the dean of Cornell Agricultural College looked at it and declared flatly that it wouldn't grow anything in the way of crops. It was condemned as completely worthless and yet it grows great crops of lush vegetables.

What's the answer?

The solution to this apparent riddle is in the treatment the land received. Instead of loading the sandy soil with artificial fertilizers as is done on nearby intensive truck farms and where sprays must be used in ever-increasing quantities, Gericke loaded the soil with organic matter from various sources. Heavy cover crops are his mainstay because he has a special problem working with sand. Although quick results are apparent in sand and from the addition of organic



A few of Gericke's goats and his compost pile.



Gericke's Organic vegetable stand attracts customers from many miles away.

matter, is is difficult to maintain a high organic content because of leaching. Because of this, Gerickle allows his cover crops to grow very lush before working them into the soil with his Rototiller. Decomposition in such soil is very fast compared with clay soils and the fields are ready for planting sooner.

A Staten Island coffee factory was being dismantled and there was a large amount of coffee beans to be discarded. Gericke persuaded the owners to dump fifty-six truckloads of the beans on his land and it made wonderful dark humus.

A herd of purebred goats provides manure which is incorporated with their bedding and other vegetable wastes into two large compost bins made of uncemented cinder blocks.

Incidently, these goats have an earth-floored barn which is free of the odor usually associated with goats and their sleek pelts attest to the fact that they have won many a grand championship at shows. Gericke says that they achieve their finest condition when they are fed on sunflower stalks and seeds raised organically. The only time they have had trouble with their animals was when they were obliged to buy commercially-grown hay and feed from outside their own farm.

The goats are useful in another way besides providing milk and manure. When Gericke wants to clear another patch of land he simply encloses it with electric fencing and the goats strip the brush. This may be done with cows and sheep, too, all of whom add fertility to the soil as they work at their brush-clearing task without regard to hours or wages.

Now five years on an organic basis, Gericke started with small patches and suffered many bugs and worms in his vegetables at first. But he stuck to the organic line and each year as his land improved, the pests became less and less until they are no longer a factor. He freely admits that he has some bugs on the farm, but they are now so few and do so little damage that they do not even figure into the accounting nor could they induce him to use any kind of spray. In fact, Gericke's father bought some spray twelve years ago, read the directions,

These are some of the coffee wastes that Gericke used to improve the fertility of his land.

Gericke found that he could charge normal prices for his produce and make more profit than the average grower. His reduced fertilizer costs allowed him a greater profit.

decided it was all too much bother and the can is still sitting there unopened.

As to crops, Gericke raises all the standard vegetables, including carrots, beets, beans, tomatoes, etc. and also a few less usual items such as Chinese cabbage and okra. He thought he had planted far more okra than he would need, but a great many Southerners had moved to Staten Island and when they heard that Gericke had organically-grown okra they cleaned him out. There's a hint here for other farmers who operate near special regional or nationality groups—find out their preferences for foods not usually raised locally and please their tastes with their favorite foods grown organically. Gericke is doing this profitably.

Because of the present high humus content of his soil Gericke was able to plant earlier than neighboring truck farms and had sweet corn to sell June 26 and tomatoes early in July. Many of these tomatoes were local showpieces, weighing 1¼ pounds and selling for 28c to 30c apiece. Now customers clamor so insistently for Gericke's organic vegetables that he is obliged to harvest such items as beets, carrots and tomatoes before they even reach mature size. We were among those who couldn't wait. Since we were short of beets and carrots in our own garden this year, we bought a bushel of each from Gericke and the taste was incomparable.

A curious and heartening occurrence helped to build Gericke's business. Some early customers consistently refused to buy tomatoes or cucumbers; the former gave them a rash and the latter "talked back." Gericke had so much faith in his organically-grown vegetables that he gave free cucumbers and tomatoes to these people if they would just try them. They did and have been steady customers for these items ever since. The cucumbers, instead of repeating, made repeat customers, the best kind. Oddly, most of Gericke's customers come from a distance.

Since the reasons for using organic plant foods rather than artificial chemical fertilizers are rather complex to the layman, Gericke stresses the fact that his vegetables have not been sprayed with poison and finds that this information is all his customers need to know to be eager to buy from him. It's a relief to any customer to know that he can pick up a tomato or apple off the stand and eat it on the spot without first having to scrub it with soap and water to remove a gray film of poison.

In spite of the superior quality of his produce, Gericke keeps his prices competitive. I asked him why he did not charge premium prices for organically-grown vegetables and he said there were several reasons for this. In the first place he likes to bring the benefit of naturally-grown foods to as many people as possible and he can best do this by not charging excessive prices. In the second place, and this is important to any farmer contemplating going organic, he finds it cheaper to raise crops organically. And what's more, many of his customers who are familiar with Staten Island farming practices, know that he does not have to buy fertilizer or spray or spend time applying either and therefore they, too, feel that premium prices would not be justified since he is already making extra profit over his competitors simply by farming organically.

On the personal side, the Gerickes are enjoying the benefits of the organic foods they raise and gleaning another extra profit in the form of wonderful health. The elder Gericke told us that in the past twenty-six years, in raising five children, he has had to spend only $100 on doctors in all that time. How many families spend more than that every year! And young Richard is one of those rare persons who has never had a cavity in his teeth, simply because his father has always believed that food should be raised the natural way. It was because of his father's long-time belief in growing foods naturally that Richard Gericke was able to come unscathed through the chemical indoctrination of his college training. The elder Gericke has always wanted to see his son have an organic farm so he has been behind Richard 100% in their organic enterprise.

The thing which has always impressed my wife and me in visiting and talking to organic farmers has been the complete enthusiasm for organiculture and the eagerness to discuss organic methods and benefits with anyone who will lend an ear. This is true of the Gerickes, too, for every customer who goe saway from The Organic Farm takes with him, in addition to a basket of God's good food, an idea which is spreading from farmer to farmer and from customer to customer as well. And when enough customers learn the truth there won't be any more artificial chemical fertilizers or poison sprays used in growing food.

Brewery Wastes

Two kinds of brewery wastes are available for fertilizing purposes, material composed of hops and material left over from the mashing process, composed of grain parts. The latter decays readily, whereas the former is rather resistant to bacterial action. This is only natural since hops are used for precisely that purpose in the brewing process. Wet brewer's grain was found to contain almost one per cent of nitrogen, but analyses of used hops are not available. Since moist hops pack quite heavily it is suggested to use such material with goodly amounts of manure. Farmers who have much manure at their disposal and who can gets hops and brewery wastes for the hauling could easily produce valuable compost for sale to nurserymen.

EROSION

A Disease of the Soil

By Sir Albert Howard

Conclusion

Reprinted from *An Agricultural Testament*

JAPAN provides perhaps the best example of the control of soil erosion in a country with torrential rains, highly erodible soils, and a topography which renders the retention of the soil on steep slopes very difficult. Here erosion has been effectively held in check, by methods adopted regardless of cost, for the reason that the alternative to their execution would be national disaster.

The great danger from soil erosion in Japan is the deposition of soil debris from the steep mountain slopes on the rice-fields below. The texture of the rice soils must be maintained so that the fields will hold water and allow the minimum of through drainage. If such areas became covered with a deep layer of permeable soil brought down by erosion from the hill-sides, they would no longer hold water, and rice cultivation—the mainstay of Japan's food-supply—would be out of the question. For this reason the country has spent as much as ten times the capital value of eroding land on soil conservation work, mainly as an insurance for saving the valuable rice lands below. Thus, in 1925 the Tokyo Forestry Board spent 453 yen (11 dollars) per acre in anti-erosion measures on a forest area, valued at 40 yen per acre, in order to save rice-fields lower down valued at 240 to 300 yen per acre.

The dangers from erosion have been recognized in Japan for centuries and an exemplary technique has been developed for preventing them. It is now a definite part of national policy to maintain the upper regions of each catchment area under forest, as the most economical and effective method of controlling flood waters and insuring the protection of rice in the valleys . For many years erosion control measures have formed an important item in the national budget.

According to Lowdermilk, erosion control in Japan is like a game of chess. The forest engineer, after studying his eroding valley, makes his first move, locating and building one or more check dams. He waits to see what Natures's response is. This determines the forest engineer's next move, which may be another dam or two, an increase in the former dam, or the construction of side retaining walls. After another pause for observation, the next move is made and so until erosion is checkmated. The operation of natural forces, such as sedimentation and re-vegetation, are guided and used to the best advantage to keep down costs and to obtain practical results. *No more is attempted than Nature has already done in the region.* By 1929 nearly 2,000,000 hectares of protection forests were used in erosion control. These forest areas do more than control erosion. They help the soil to absorb and maintain large volumes of rain-water and to release it slowly to the rivers and springs.

China, on the other hand, presents a very striking example of the evils wihch result from the inability of

the administration to deal with the whole of a great drainage unit. On the slopes of the upper reaches of the Yellow River, extensive soil erosion is constantly going on. Every year the river transports over 2,000 million tons of soil, sufficient to raise an acre of 400 square miles by 5 feet. This is provided by the easily erodible loess soils of the upper reaches of the catchment area. The mud is deposited in the river bed lower down so that the embankments which contain the stream have constantly to be raised. Periodically the great river wins in this unequal contest and destructive inundations result. The labour expended on the embankments is lost because the nature of the erosion problem as a whole has not been grasped, and the area drained by the Yellow River has not been studied and dealt with as a single organism.

The difficulty now is the over-population of the upper reaches of the catchment area, which maintained effective control of the upper reaches —the real cause of the trouble—the erosion problem in all probability would have been solved long ago at a lesser cost in labour than that which has been devoted to the embankment of the river. China, unfortunately, does not stand alone in this matter. A number of other rivers, like the Mississippi, are suffering from overwork, followed by periodical floods as the result of the growth of soil in the upper reaches.

Although the damage done by uncontrolled erosion all over the world is very great, and the case for action needs no argument, nevertheless there is one factor on the credit side which has been overlooked in the recent literature. A considerable amount of new soil is being constantly produced by natural weathering agencies from the sub-soil and the parent rock. This when suitably conserved will soon recreate large stretches of valuable land. One of the best regions for the study of this question is the black cotton soil of Central India, which overlies the basalt. Here, although erosion is continuous, the soil does not often disappear altogether, for the reason that as the upper layers are removed by rain, fresh soil is re-formed from below. The large amount of earth so produced is well seen in the Gwalior State, where the late Ruler employed an irrigation officer, lent by the Government of India, to construct a number of embankments, each furnished with spillways, across many of the valleys, which had suffered so badly by uncontrolled rain-wash in the past that they appeared to have no soil at all, the scrub vegetation just managing to survive in the crevices of the bare rock.

How great is the annual formation of new soil, even in such unpromising circumstances, must be seen to be believed. In a very few years, the construction of embankments was followed by stretches of fertile land which soon carried fine crops of wheat. A brief illustrated account of the work done by the late Maharaja of Gwalior would be of great value at the moment for introducing a much needed note of optimism in the consideration of this soil erosion problem. Things are not quite so hopeless as they are often made to appear.

Why is the forest such an effective agent in the prevention of soil erosion and in feeding the springs and rivers? The forest does two things: (1) the trees and undergrowth break the rainfall into fine spray and the litter on the ground protects the soil from erosion; (2) the residues of the trees and animal life met with in all woodlands are converted into humus, which is then absorbed by the soil underneath, increasing its porosity and water-holding power. The soil cover and the soil humus together prevent erosion and at the same time store large volumes of water. These factors —soil protection, soil porosity and water retention—conferred by the living forest cover, provide the key to the solution of the soil erosion problem. All other purely mechanical remedies such as terracing and drainage are secondary matters, although

of course important in their proper place.

The soil must have as much cover as possible; it must be well stocked with humus so that it can drink in and retain the rainfall. If follows, therefore, that in the absence of trees there be a grass cover, some cover-crop, and ample provision for keeping up the supply of humus. Each field so provided suffers little or no erosion. This confirms the view of Williams (Timiriasev Academy, Moscow) who, before erosion became important in the Soviet Union, advanced an hypothesis that the decay of past civilizations was due to a decline in soil fertility, consequent on the destruction of the soil's crumb structure when the increasing demands of civilization necessitated the wholesale ploughing up of grass-land.

Williams regarded grass as the basis of all agricultural land utilization and the soil's chief weapon against the plundering instincts of humanity. His views are exerting a marked influence on soil conservation policy in the U. S. S. R. and indeed apply to many other countries.

Grass is a valuable factor in the correct design and construction of surface drains. Whenever possible these should be wide, very shallow and completely grassed over. The run-off then drains away as a thin sheet of clear water, leaving all the soil particles behind. The grass is thereby automatically manured and yields abundant fodder. This simple device was put into practice at the Shahjahanpur Sugar Experiment Station in India. The earth service roads and paths were excavated so that the level was a few inches below that of the cultivated area. They were then grassed over, becoming very effective drains in the rainy season, carrying off the excess rainfall as clear water without any loss of soil.

If we regard erosion as the natural consequence of improper methods of agriculture, and the catchment area of the river as the natural unit for the application of soil conservation methods, the various remedies available fall into their proper place. The upper reaches of each river system must be afforested; cover crops including grass and leys must be used to protect the arable surface whenever possible; the humus content of the soil must be increased and the crumb structure restored so that each field can drink in its own rainfall; overstocking and over-grazing must be prevented; simple mechanical methods for conserving the soil and regulating must be utilized. There is, of course, no single anti-erosion device which can be universally adopted. First and foremost is the restoration and maintenance of soil fertility, so that each acre of the catchment area can do its duty by absorbing its share of the rainfall.

Muck

In English agricultural language, muck invariably refers to farmyard manure. In American usage, muck is more apt to mean half-decayed, black peat or other organic plant matter from bogs mixed with earth and of black coloring. Such muck may be very high in minerals, but had best be allowed to freeze through the winter before being disced in or plowed under.

Small headed sunflowers like these can be combined with standard equipment.

Mammoth Russian sunflowers are so bulky that they must be harvested by hand.

A New Look for Sunflowers

Once A Curiosity, The Sunflower is Now a Cash Crop

By Archer P. Whallon

AMONG the many curious confusions of agricultural terminology, possibly the ones but second to the absurdity of the name "turkey" for our Thanksgiving day feast bird, are the strange names given to our native sunflower plants—"Jerusalem artichoke" and "Russian" sunflower. Like those other misnomers in farm language, the "Irish" potato and "buckwheat", they stem from a mixture of early geographical ignorance and language misunderstanding and mispronunciation. Buckwheat is regarded as a mispronunciation of the German word for "beechwheat", and the word "Jerusalem", as applied to the tuberous sunflower, is supposed to be due to a mispronunciation of the Italian word, "girasol", meaning a sunflower. The term "Russian sunflower", of course, comes from the fact that Russia has for long been the leading sunflower growing country, quite as "Irish potato" is due to the predominance of that vegetable in Ireland.

But if these confusions of language are little more than amusing, the strange lack of appreciation on the part of supposedly normal Americans of the sunflower plants, can hardly be defined in such charitable terms. With the great stock of plant material, a heritage from the American Indian agriculture, the palefaced invader has done none too well. He has done very well with the corn plant, fairly well with the potato, and is now developing a big and diverse sweet potato industry. While he has done altogether too much for his own good with tobacco, with the sunflower, potentially the most valuable of native American plants, his performance has been a strange and stupid failure.

But a tardy awakening and reformation has set in. It is not now a fantastic prophecy that in a decade or less, the pace of increasing appreciation of the sunflower will be greatly accelerated, and to our grandchildren the sight of a big sunflower field will be as commonplace as that of a big corn field. Remember, the now ubiquitous soybean was long an "old but neglected" crop, for a century dormant and little regarded by American farmers. So also were lespedeza, sweet clover, and the grain sorghums, and it is questionable if one of them has the intrinsic value of the sunflower.

In the year 1615 when Champlain explored the Georgian Bay district of Ontario, he found the Indians cultivating sunflowers, and now, over three-hundred years later, we find that pioneer work in the revival of sunflower growing is a Canadian project. In the interim, the sunflower plant had been taken to Russia and had there reached the stature of a major farm crop. In 1937 the Soviets produced six million tons of sunflower seed oil, while the United States crop was trivial.

There have been, of course, sporadic attempts to make more use of the sunflower plant here in North America, mainly for silage in mixtures with corn and other crops. In 1892 the first sunflower silage was produced at the Central Experimental Farm at Ottawa, Canada. One kind of silage, known as the Robertson mixture, consisted of sunflowers, corn, and horse (fava or broad) beans; the object being to increase the fat content of the dairy ration. But little difference in the feeding value of corn and sunflower silage was found, the smaller proportion of carbohydrates and nitrogen-free extract in the sunflowers being offset by a higher fat content.

In the mountainous regions of New York State, as well as in other short season regions where corn crops cannot be depended upon, sunflowers may double the quantity of silage under unfavorable conditions. A mixture of 25 per cent sunflower plants in the corn field has resulted in more than 50 per cent of sunflowers by weight at harvest time. Sunflowers come up more quickly than corn; they grow in both dry and colder soil, mature quicker, and can be planted both earlier and later in the season than corn. In the fall, nearly mature sunflowers will withstand more frost than corn and will make fully ripe heads where frosted corn will be soft and of low feeding value and poor keeping quality. The seeding expense for sunflowers is relatively low, in thirty-six inch rows with plants six inches apart in the row, but seven pounds per acre. When sunflowers are planted with corn, only about two pounds per acre are required.

One factor which has discouraged sunflower growing has been the poor selection of varieties available to American farmers. Most Eastern American seed houses list only the old-fashioned tall-growing Mammoth Russian variety, with the exception of ornamental or flower garden types. The common big Russian sunflower, often growing ten feet tall and with a large heavy head, is inconvenient and troublesome to harvest and handle with machinery. The top-heavy plants often blow over and lodge, and the big seed heads are hard to cure. With the development of improved varieties these objections are largely overcome.

During the war years British agricultural scientists, in their search for edible oil and grain plants more suited to the British climate than the corn plant, imported many sunflower varieties from Russia and Argentina. But the outstanding research work in the development of improved sunflowers has been done in the western prairie Canadian provinces, at the experimental farms at Saskatoon, Saskatchewan and at Morden, Manitoba. The Mennonite prairie farm settlers had a Russian type of sunflower, better than the common large sunflower familiar to eastern American farmers, but still lacking the uniformity of plant height required for successful mechanical, particularly combine harvesting.

Canadian research workers, through selection of the better strains of this variety and crossing with varieties from the Soviet Union and from Argentina, have developed several dwarf or semi-dwarf sunflowers growing to uniform heights of scarcely four and not over five feet, making large scale combine harvesting practical. These also are heavier producers of better quality seeds. It should be noted that individual sunflower head size, the size of the individual seeds, or the color of the seeds are important considerations as are plumpness or weight of the seeds and a relatively low proportion of hull and chaff. These improved varieties bear such names as—Mars, Pole Star, Jupiter, Southern Cross and Sunrise.

In my own southern Michigan garden trials, I was quite favorably impressed with the black-seeded Jupiter, a dwarf-growing variety with very thick, plump, thin-hulled and heavy seeds. At present, the most widely grown of the newer varieties is Sun-

rise, a selection made at Saskatoon from promising stock seed from Soviet Russia.

However, the outstanding achievement in sunflower breeding is the development of the hybrid sunflower —Advance. This is possibly the forerunner of a new race of hybrid sunflowers corresponding in promise with the development of hybrid corn. The Advance hybrid sunflower is a cross of inbred strains of Mennonite and Sunrise. This is produced much as hybrid corn is produced, but the process is somewhat easier, as the female parent of Advance is usually self-sterile, and when six rows of the female parent are planted beside two rows of the virile male parent, the fertilization process is easily accomplished. The hybrid seed is harvested only from the female rows. The Advance hybrid is earlier and more productive than Sunrise and other varieties, has a seed with a better oil content and with less hull waste, the heads do not easily shatter, and as they grow inverted, offer some resistance to birds.

A revival of interest in sunflower growing in the United States, following the development of these better varieties, is indicated by recent experimental work at the University of Illinois where a group of investigators believe that the production of sunflowers for commercial purposes will become a project of national magnitude.

Professors R. O. Weibel and A. L. Lang, with nine cooperating Platt county farmers have grown approximately a hundred acres of the improved Canadian sunflowers, and Mrs. Royene F. Owen, home economics instructor at Urbana, has demonstrated that sunflower seed meal can be made into very nutritious and palatable food for humans. These reports from the University of Illinois state that sunflower seed meal is a good source of B-complex vitamins as well as of protein. Also, that the meal contains approximately 150 per cent more niacin than wheat germ, and more pantothenic acid than soybean meals. In addition to the meal, sunflower seed yields 25 to 30 per cent by weight of a fine-flavored, high-quality oil used for food products, soaps, paints, plastics, and other purposes.

In my own experience I have found that the short Canadian "combine" sunflowers were even more effective as a weed-smother crop than the tall-stalked varieties. The foliage of the dwarf sunflowers is just as heavy, and the ground shade really darker. Planted in three-foot rows the shade under dwarf sunflowers of not over four feet is so dense that practically no weeds will grow.

One might reasonably expect that a crop of these heavy-leaved sunflowers would be an excellent weed-eliminating and soil conditioning crop for muck lands preparatory to planting mint, onions, or other truck crops the following season. For this purpose they would be a far more effective and safer plant than corn, as sunflowers grow faster and are more easily cultivated, are most frost resistant, and might well become a major factor in muck land farming. It is reported too, that the sunflower stalk has value as a textile or cordage fiber crop, and that rope is made from this source in Russia. Seemingly, the shredded or crushed stalks would be a good sterile or weed seed free dairy house bedding or litter, and that there could be developed a considerable by-product business in this line.

Most all the work in sunflower development has been with the single-stalked large heading type, but for some special purposes a branching multiple flowered variety would be desirable. This would be the case for sunflowers grown as a companion and supporting crop for vetch, pole beans, Creole peas, Austrian and Dixie Wonder winter peas, crotalaria, and a variety of climbing vine crops. It is with this objective in view that the writer is searching for superior large seed bearing strains of the branching sunflower, believing that this also has a large place in American agriculture.

How to Build Storage Cellars

By Frank D. Steiner

Consulting Engineer

As the greater part of any crop must be preserved, it is important that storage problems be discussed in every detail. Canning can never solve the storage problem satisfactorily. Canning destroys vitamins and leaches out minerals. In matters of storage, the organic method calls for its logical counterpart, an organic form of storage able to preserve the vitamins and minerals during the winter and the following spring. In order to preserve the surplus of his crop in a garden-fresh condition, the organic farmer should have organic storage facilities. Products worth their weight in gold deserve the best storage rooms. Marketed during the winter and the spring, such products fetch the highest prices, more than enough compensation for capital investment and labor involved. Besides, there is pride and satisfaction in fully preserving what has been the object of the greatest care and attention. Moreover, to put up a front against waste and losses is part of the good management which always precedes success.

Farm produce is real live stuff with a definite need for air, humidity and a temperature most conducive to its preservation. Old-fashioned cellars built with natural stones and lime mortar may not satisfy modern standards, but they are still second to none for good storage. The same holds good for old caverns cut in rock or sandstone, formerly appreciated by brewers, now abandoned and dilapidated. These natural cellars could easily be restored and modernized as will be shown later in this discussion.

The old-fashioned cellar is known for its suitable humidity and its low and even temperature the year round. These are the main features of a good storage cellar, and they are achieved without mechanical gadgets.

However, most farmers and gardeners cannot avail themselves of such natural cellars, and must make use of their basements or other suitable buildings which originally were not intended to be used as storage rooms.

Nearly all basement cellars need certain precautions to insure good storage. Provided underground water does not interfere, the cellar floors should be made with compacted loamy soil; they are the best and also the least expensive. Floors loosely paved with pebbles or bricks (no mortar joints) are also very satisfactory. A great deal depends on subsoil conditions. In some cases graveled floors are better, while concrete floors always prove detrimental to good storage unless special air-conditioning and cooling equipment is provided for. Good storage cellars, however, can be built without such equipment. All that is needed is the application of a few basic principles.

Basement cellars with concrete floors are nearly always too dry. Apart from that, a basement cellar usually has another fiend. It's the furnace or the oil burner. It is not possible to maintain a low end even temperature in the vinicity of a furnace unless there is good insulation. Partitions should be made of bricks, at least 8 inches thick, and good care should be taken

Figure 10. A two story "Organic" storage cellar with subsoil ventilation.

that all joints, especially the vertical joints, are well filled with mortar. The door leading to the cellar should not face the furnace, and should be heavy, tight and well fitting. Otherwise, all other precautions will have been made in vain. Double doors, with an air space in between, would be ideal.

Cleanliness is one of the first things to be observed in storage cellars. Walls and ceiling should be whitewashed and the floor must be kept clean at all times. Dead leaves, stalks, etc., must be removed from under shelves and planking. Spring cleaning is obligatory and it is best done during dry summer days. Shelves, crates, baskets, etc., must be brushed in the open air or with all windows open. Beside thorough airing, the burning of incense often proves helpful in bringing about a healthy atmosphere.

The following precautions need be taken in a concreted basement cellar. Provide a layer of coarse, well washed gravel, 3 inches thick, on the basement floor. The pebbles should be about equal in size. The shelves and all other equipment are then placed on the gravel. Whenever the cellar air gets too dry (a hygrometer will tell) the gravel is sprinkled with a watering can. Care must be taken,

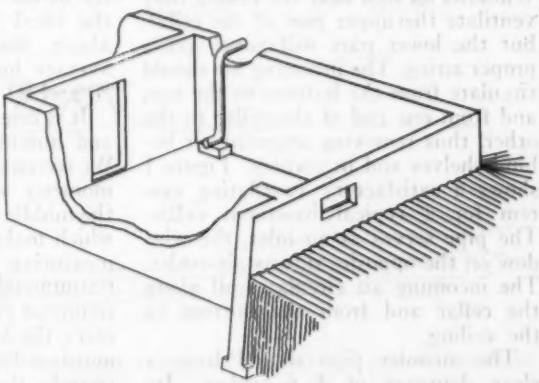


Figure 1. A cellar converted into a storage cellar.

however, that no surplus water is left on the floor.

The wet gravel on the floor will evaporate much more water than on the floor alone, the gravel having a much greater surface area. This sprinkling has to be repeated when the relative humidity of the air falls below 80 per cent, and for this reason a watering can should always be kept in the cellar. It must be said that one sprinkling usually goes a long way, especially when the cellar is filled to capacity. Garden-fresh produce releases a considerable amount of humidity, any surplus of which can usually be removed with moderate ventilation. However, harsh and prolonged ventilation, open doors, insufficiently insulated walls and doors or a sudden change of outdoor humidity can disturb this balance and make water sprinkling necessary.

Too much humidity and insufficient ventilation may, at times, promote the growth of micro-organisms on damp parts. This, however, can be checked by ventilating more thoroughly. Such growth can be checked in its early stage with a pinch of potassium permanganate added to every gallon of sprinkling water which will turn a light pink. The permanganate is obtained in drugstores. It is a mild disinfectant without odor or any other ill-effects.

To rely on windows alone for effective ventilation would be a fallacy. Windows located near the ceiling may ventilate the upper part of the cellar, but the lower part will never get a proper airing. The incoming air should circulate from the bottom to the top, and from one end of the cellar to the other, thus removing stagnant air behind shelves and in corners. Figure 1 shows a satisfactory ventilating system for a typical basement cellar. The pipe serves as air-inlet, the window on the opposite side as air-outlet. The incoming air circulates all along the cellar and from the bottom to the ceiling.

The air-inlet pipe should have a clear diameter of 4-6 inches. Its upper end may be installed in a window opening but care must be taken that no leakage prevails at that point. To this effect the pipe is set in a pipe sleeve and the clearance is stuffed with oakum dipped in hot asphalt. Outside, the pipe-opening should point to the north or north-east, and it should be about 2 feet from the ground. The orifice must be covered with a strong galvanized gauze as protection against mice and other animals. It may also be shielded against rain if need be.

Inside the cellar the lower end of the pipe rests on a pad about 2 inches above the gravel. The orifice should point in the long direction of the cellar, and there should be an air-outlet window at the other end. The air-inlet is stopped with a wooden plug in the cellar. This arrangement assures a good airing of the main parts of the cellar. The early morning hours are best for letting cool air into the cellar. Ventilation must be limited to a few minutes or eliminated entirely during very cold weather, as the cellar temperature should not drop to freezing point. However, freezing temperature will not do serious damage to the goods for the first 2 or 3 days. The best temperature and humidity will mainly depend on the stored goods. Some products need less humidity, others need more; the same applies to temperature. The products should be harvested and stored during dry weather, thus avoiding surplus humidity in the cellar. For most products, the ideal temperature is only little above the freezing point, and the average humidity may vary between 80 and 90 per cent.

It is essential that both temperature and humidity be checked every day. We recommend a sturdy mercury thermometer which should be placed in the middle of the cellar and at a height which makes reading convenient. For measuring the relative humidity we recommend a psychrometer (an instrument consisting of two thermometers, the bulb of one of which is kept moistened). This instrument always records the exact relative humidity while the ordinary hair hygrometer is

subject to considerable fluctuations. In any case, a hair hygrometer should be checked every autumn by a competent specialist, as it does not give accurate readings for more than 6 months. On the other hand, a psychrometer never needs checking and adjusting and always gives true and accurate readings. Furthermore, the psychrometer replaces the ordinary thermometer, as the temperature can also be obtained from the psychrometer.

All cellar windows must be shaded or boxed in so as to prevent the entrance of daylight when they are open. If the cellar is more than 20 feet long a small fan or a gravity ventilator should be installed in the outlet window. Both should be so constructed as to permit free discharge of air when operating. The fan should have dampers that close automatically when power is shut off, thus making the opening weather-proof. Gravity ventilators have no revolving parts and require no power; they have been found most satisfactory for small and large storage cellars.

Underground cellars or caverns, cut in solid rock, with only an entrance opening, are usually a bit too damp and are lacking in fresh air.

Such caverns can be transformed into perfect storage cellars with little expense. Figure 2 shows how it can be done. For the benefit of those who cannot get the complete picture we give a brief résumé:

The entrance opening should be made big enough to hold at least a normal-sized door frame. The door must be heavy and tight. It would be better to have an outer door and an inner door both 6 to 8 feet apart from each other. This would insure perfect insulation from the outside.

All along the cavern floor a trench is dug up or cut so as to hold a pipe line with 4-6 inches clear diameter. This pipe line is embedded in and covered with gravel. From the base

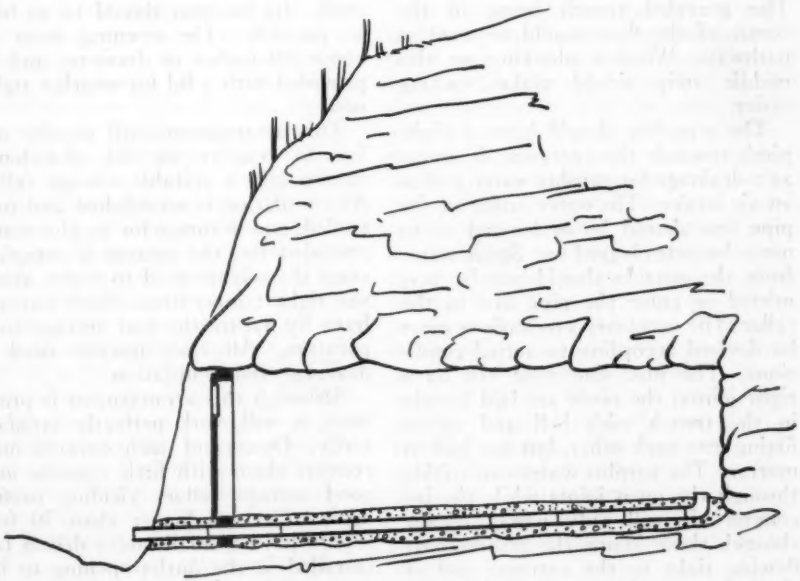


Figure 2. Caverens can be made into storage cellars if they are properly ventilated.

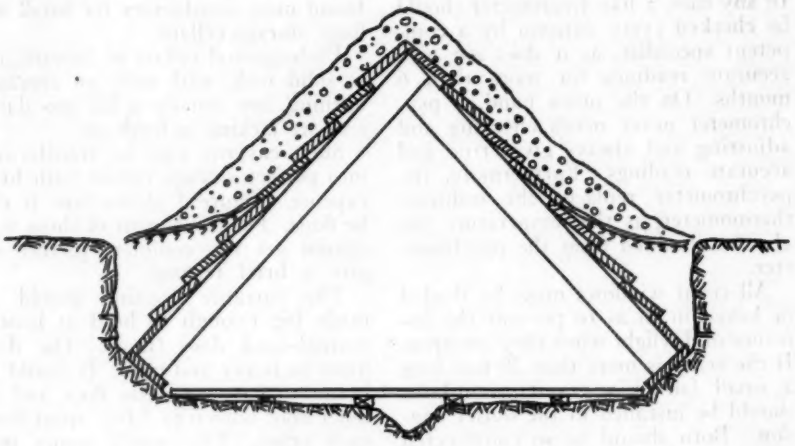


Figure 3. A temporary field-type of storage cellar.

up to about 6 feet high the cavern walls should be perpendicular so as to provide suitable space for shelves or crates on each side of the trench. The graveled trench being in the centre of the floor would be used as pathway. Wooden planking on this middle strip would make walking easier.

The pipe line should have a slight pitch towards the entrance; it serves as a drainage for surplus water and as an air intake. The outer orifice of the pipe line should be so located as to never become clogged up. Sewer water from the outside should not be permitted to enter the pipe line in the cellar. The necessary precautions must be devised according to actual conditions. The pipe line need not have tight joints; the pipes are laid loosely in the trench with bell and spigot fitting into each other, but not laid in mortar. The surplus water can trickle through the open joints while the incoming air will only partly escape through these joints, the greater part flowing right to the extreme end of the pipe line. A sturdy wooden plug can be used for stopping the air inlet. The outer orifice should be capped with strong rust-proof wire gauze as a protection.

The air outlet is best located at the top of the door frame or in the door itself. Its location should be as high as possible. The opening must be about 10 inches in diameter and be provided with a lid for weather tightness.

This arrangement will usually suffice to convert an old, abandoned cavern into a suitable storage cellar. As ventilation is established and controlled, and drainage for surplus water provided for, the system is complete since there is no need to worry about the right temperature. Such caverns have by nature the best storage temperature. All they usually need is drainage and ventilation.

Although this arrangement is primitive, it will work perfectly satisfactorily. Owners of such caverns may convert them with little expense into good storage cellars yielding profits again. Caverns longer than 30 feet should have a small power-driven fan installed in the outlet-opening to insure sufficient airing.

There are multiple caverns with several gangways and several exits

and even with head openings. Such caverns can even more easily be transformed into excellent storage cellars provided each and every opening is controlled for air intake or air outlet, and entrance of light. After a survey and a close study it will often be found that some of the openings can be sealed permanently because they are neither useful nor necessary for the proper conditioning of the cavern. In multiple caverns with head openings the air inlets should be located at the lowest points and suitably distributed so as to have equal airing in all parts. The air-outlets are best located in the head openings. A close study of the project will reveal whether gravity ventilators or power-driven fans or a combination of both types need be installed.

When permanent storage capacity is exceeded or when transportation of the crop to the farm house results in extra costs, temporary storage cellars are erected in the field, an example of which is shown in Figure 3.

After selecting a suitable spot where rain water does not easily accumulate, a trench 2 feet deep and 8 to 10 feet wide is dug up, the excavated earth being heaped on both sides of the trench, the length of which should not be less than 15 to 20 feet. Otherwise there is no limitation as to the length of the structure. On each side of the trench a sturdy board is laid against well compacted soil at an angle of about 35 - 45 degrees. These boards serve as buttresses for the gable trusses which are spaced at 1 foot center to center.

Each gable truss consists of two equal boards nailed together at the apex at a predetermined angle. The gable truss is also nailed to the buttresses when put in place. To insure stability the gable trusses must be braced diagonally with laths nailed on the inside. When all trusses are erected cover boards are nailed on the outside, overlapping each other as shown in Figure 3. Two layers of asphalt paper are fastened consecutively to these cover boards, their ends near the buttresses being turned up so as to form a gutter for surplus water during rainy periods.

Hereafter the excavated earth is evenly distributed over the entire structure, forming an earth blanket 10 inches deep or more. Such an earth blanket is the best and least expensive insulation, and is all the more effective when the sod is placed as a top layer, thus consolidating the sloping earth cover with the roots of grass.

The structure may also be covered with corrugated metal or asbestos. In this case no asphalt paper is required, and any of the afore-mentioned materials may be used to cover the front and backside of the storage cellar. Needless to say that these sides also require an adequate insulation. One of them is closed entirely and may be covered with earth, the top layer being formed by sod. Provisions must be made for a ventilation hole at the gable top. The other side must have an opening for a door and should be made with tongue and groove sheeting, covered with asphalt paper on the outside, and insulated with fiber board on the inside.

To further improve insulation, one or two layers of canvas or similar material may be placed between sheeting and fiber board. The door itself should be insulated in the same manner, and can either be hinged or held in place by staples and hasps or cabin hooks. Such a field structure, made with shovel, saw and hammer, is an inexpensive building which may last for many years. Ventilation is assured by two openings, one being in the back side at the gable top, the other in the door at the bottom. This one is the inlet, the other the outlet for air. The door opening should have a tight-fitting lid, while the outlet hole may be plugged from the outside by bundled canvas. The floor may be compacted and covered with wooden planking. A little trench may be provided in the centre of the storage cellar as a precaution against drain water.

On the whole, wood is discarded as a structural material for storage cellars because of its inherent ability to pro-

Figure 4. A barrel vaulted storage cellar being erected.

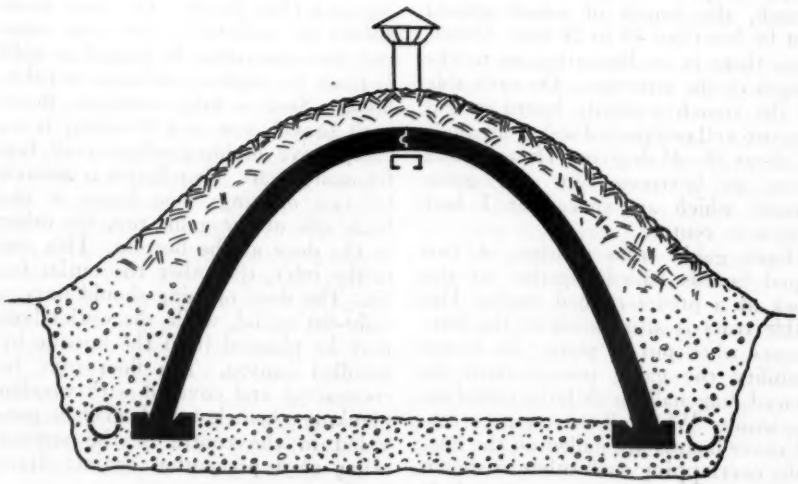


Figure 5. A cross-sectional view of a vaulted storage cellar.

vide a breeding ground for micro-organisms. A wooden structure such as described should always get a thorough spring cleaning and airing so as to preserve the wood and prevent rotting. The wooden parts may be specially treated by one of numerous methods if such treatment does not impair the purity of the cellar atmosphere.

Generally speaking, a permanent structure built with stone, brick or concrete will give better satisfaction in the long run, with little more expense added to the cost. It is within the scope of any farmer to have a modern storage cellar which he may even fabricate and erect himself.

In previous examples we pointed out how the subsoil can affect storage conditions. This dependence on subsoil conditions is often a serious handicap to farmers and distributors. The following examples show how the influence of the subsoil can be overcome without resorting to artificial devices. It will then become apparent how appropriate the term "Organic Storage" really is.

The barrel-vaulted cellar shown in Fig. 4-6 is a modern replica of the old cavern, but infinitely more salubrious and hygienic. It can be built in any size as to width, height and length with only one type of vault element, made of reinforced concrete. These vault elements can be fabricated by farm hands under the supervision of an experienced person. The main feature of this vault cellar is the built-in subsoil consisting of coarse gravel and other mineral ingredients which have specific functions to perform, as will be seen later. It can be readily seen that by laying a stratum of selected minerals, subsoil conditions can be governed to a large extent. Such a subsoil is also an air reservoir which can be tapped for ventilation.

The subsoil air can be sucked into the cellar by a power-driven fan. Nature does not tolerate a vacuum. The subsoil strata air is replenished from the outside as fast as it is drawn into the cellar. It is obvious that this subsoil acts as a filter, washing and purifying the passing air. If the gravel is wet (as would be the case in rainy weather) evaporation of water is accelerated when exposed to a draft. Such evaporation is marked by a reduction of temperature. Consequently, the sucked air is cooled and purified at the same time before entering the vaulted cellar which is subject to a natural air-conditioning process.

When the cellar is partly submerged in the ground, the owner should be sure that the water table remains well below the cellar floor at all times. The submersion has definite advantages. In the first instance, the cellar has a lower and more even temperature. Furthermore the excavated soil provides the necessary earth blanket for the cellar. Rain water is drained by two lateral drains which may end in a sump or a sewer. The depth of the earth blanket should not be less than 2 feet, sufficient protection against severe cold spells. The earth blanket also protects against warm weather. Proper use of sod will help to consolidate the surface of the earth blanket. The front-side and the back-side of the cellar can be made in concrete or in brick. Openings for

Figure 6.
A completed vaulted storage cellar.

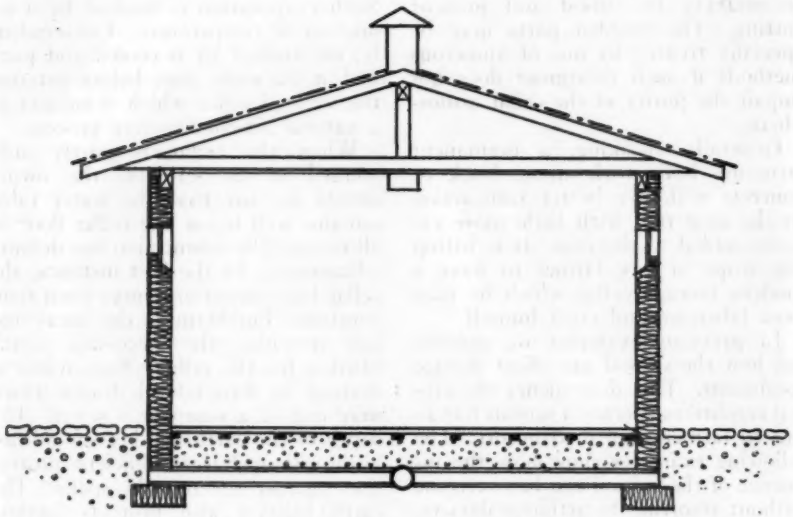


Figure 7. A storehouse cooled and ventilated by subsoil air.

a door, ventilation and windows must be provided for.

Making use of the subsoil as a medium for cool, clean air has great advantages. Such a cellar is not only independent of subsoil conditions, but also of outside temperature and humidity. When closed hermetically from the outside, such a cellar can breathe conveniently the cool, pure air from the subsoil. Subsoil air supply improves storage conditions immensely. The application of these principles opens up wide possibilities in the construction of organic storage cellars.

Fig. 7 features a storehouse cooled and ventilated by subsoil air. It is assumed that the highest water level is 4 feet from the grade. This prohibits the submersion of the storehouse. As the floor is level with the grade, trucks and other vehicles can drive in for loading and unloading. The subsoil is made up of selected mineral ingredients which provide an air reservoir. Any rain water that may accumulate along the foundation walls will flow towards the main drain in the middle of the subsoil. The drain water may be banked-up so as to create a subsoil water reservoir, able to provide the necessary humidity during dry weather. This arrangement makes humidification of indrawn air an absolute certainty.

Storage cellars above the ground must be well insulated. The walls may be built with bricks, concrete or cement blocks insulated with a mineral fiber board or some other convenient material, excluding wood.

The ventilation shaft in the centre of the ceiling is connected with a power-driven fan. The ceiling must also be well insulated, in fact, it must have the best insulation because of its exposure to the outside.

The floor may be graveled or covered with planking. If traffic conditions

call for a concrete floor, such must be provided with ventilation slots, the details of which cannot be discussed here.

In organic storage cellars it is comparatively easy to remove a surplus of humidity. If, however, the outdoor humidity remains persistently high for a long period, the owner of an organic storage cellar may have cause to worry about its dehumidification unless a special absorbent medium placed into the air path is provided for. This can be done in several ways.

Again we can resort to the purely organic method by providing a section of the subsoil with selected minerals whose absorbent properties are particularly high. This subsoil section will only be used when normal ventilation cannot remove a surplus of humidity.

One of the most efficacious and convenient processes of dehumidifying air is that used in air-conditioning plants. This process can be used in organic storage cellars without infringing upon the organic principles.

The process makes use of an absorbent agent called "Silicagel" which is a highly absorbent form of silica in crystal form, both harmless and odorless to passing air. The crystals are placed in recipients where the humid air passes through. The saturated silicagel turns red. The absorbed water is then evaporated from it by heating it. A silicagel filter in a storage cellar would not add excessively to its cost. Details of such filters cannot be given here.

Figure 8 shows a 3-story storage cellar with selected subsoil and air-inlet pipes. Rain water is collected by drains. The holes in the walls are air-inlets which can be plugged if need arises. The intermediate floors have a removable planking allowing the air to flow through. The upper floor is on a level with a loading platform as it is depicted in Figure 9. The ceiling is a reinforced slab with burnt clay fillers to insure insulation and watertightness. The depth of the earth blanket should be 2 feet or more according to the climate. If the storage cellar covers a considerable surface there is no reason why its sloping top should not be cultivated.

The submersion of this cellar implies constant absence of ground water, which should remain below the bottom floor at any time. Nevertheless such ground water should be free from

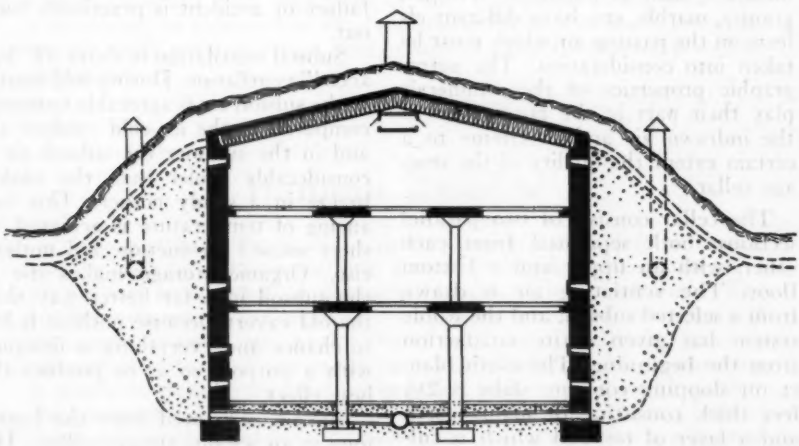


Figure 8. A three story storage cellar with subsoil and air-inlet pipes.

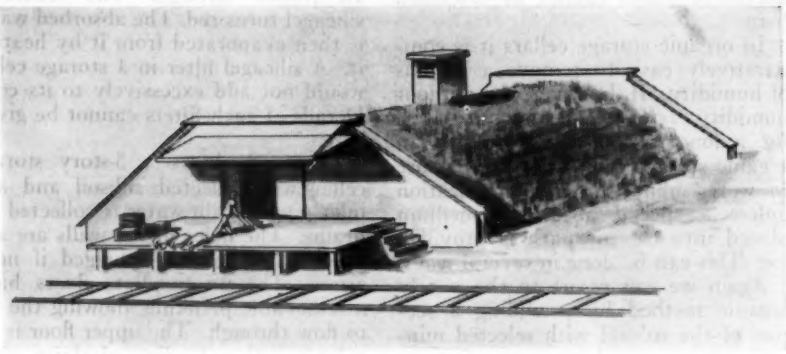


Figure 9. An artist's sketch of an "Organic" storage cellar in operation.

chemical waste products, polluted river water or like. Such conditions would have a disastrous effect upon the storage conditions. Before building deep storage cellars on the organic principle it will be absolutely necessary to investigate into the levels of the ground water and its quality. However, in most rural areas the ground water is pure and free from harmful ingredients.

The selected subsoil is not merely an absorbent medium. The various minerals, such as limestone, feldspar, granite, marble, etc. have different effects on the passing air which must be taken into consideration. The petrographic properties of these minerals play their part in the purification of the indrawn air and determine to a certain extent the quality of the storage cellar.

The cellar consists of two parallel sections, both separated from each other, with an upper and a bottom floor. The ventiating air is drawn from a selected subsoil, and the whole system has given entire satisfaction from the beginning. The earth blanet on slooping concrete slabs is 2½ feet thick consisting of loamy earth and a layer of top soil which is cultivated.

The earth blanket provides an insubsoil, and the whole system has giv-by an artificial material in effectiveness and low cost. The grass on the sloping blankets has not been cut as the owners want as firm a sod as possible in order to consolidate the blanket and prevent its slippage.

This organic storage cellar has a volume of 5000 cubic yards. Practically the whole bottom floor is "suction" area from where subsoil air oozes into the cellar. This makes ventilation highly effective, very smooth and even. Harsh ventilation due to oversight, failure or accident is practically ruled out.

Subsoil ventilation is above all "balanced" ventilation. During cold weather the subsoil air is agreeable tempered compared to the ice-cold outdoor air, and in the summer the subsoil air is considerably cooler than the coolest breeze in a shady corner. This balancing of temperature is achieved by sheer subsoil air suction and nothing else. Organic storage makes use of the subsoil in a far better way than the old cavern because nothing is left to chance and everything is designed with a purpose so as to produce the best effect.

Success is assured from the beginning in an organic storage cellar. The first large-scale experiment proved its worth right from the start. All the

goods keep remarkably garden-fresh, and home-grown apples keep perfectly fresh until June the following year. Shrinkage, loss of weight, unsightly wrinkles, decay and spoilage belong to the past. This service to customers and public health is compensated by maximum market prices obtained in the season when fresh fruits are scarce.

The dollar saving is an established fact; not only with respect to invested capital, but to running costs and effectiveness, which are more important. Apart from power-driven fans and some measuring and recording instruments, there are no other mechanical devices in an organic cellar. This reduces the initial costs considerably.

Since the first organic storage cellar was built, half-a-dozen more have been put into operation with even greater success. Besides, a number of existing basement cellars (with concrete floors) and some abandoned caverns have been improved to a considerable degree.

The structures shown in this article have been designed by the author. Copyright on the term Organic Storage Cellars is pending.

Beet Wastes

In the sugar beet growing regions, beet wastes are easily available. Much of that material can be used for ensiling or feeding, but plenty could be composted. Numerous analyses of beet roots showed that their potash content varied from .7 to 4.1 per cent; the variation in nitrogen is less pronounced, and an average might be .4 per cent, while phosphorus ranges from .1 to .6 per cent. Astonishingly enough, the leaves are not very different in their make-up, although their content in calcium and magnesium far exceeds that of the roots.

Where beet wastes can be used for feeding, the sound farmer will do so, since he will in the end obtain valuable manure, besides having saved on energy food and pasture; where for some reason, such as labor costs or contracts with processors, feeding is impossible, the beet residues should be returned to the land, either as part of sheet compost, dressed with manure, or as part of composting by the heap or pit methods.

Banana Residue

Analyses have shown that banana skins and stalks are extremely rich in both phosphoric acid and potash, rating from 2.3-3.3 in phosphoric acid and from 41 to 50 per cent in potash, on an ash basis. The nitrogen content is not given in the literature, but must be relatively high, because these residues decompose very readily and must therefore offer an almost complete diet for bacteria. When available in quantity, it would be thoroughly practical to utilize banana residues for gardening purposes. Table cuttings and kitchen refuse containing banana skins are valuable also for the reason that these materials contain large amounts of bacteria which effect quick break-down and act as activators for the rest of the compost material.

Another Look At Trace Elements

By Leonard Wickenden

Author of Make Friends With Your Land

Part Two—Proceed With Caution!

IT IS characteristic of most, if not all, of the trace elements that, while they appear to be beneficial in extremely small amounts, they are disastrously toxic in slightly larger amounts. You may feel that we need not worry about that because we can be careful not to use them in quantities large enough to be poisonous. The difficulty is, however, that the margin between what is safe and what is dangerous is narrow and even the larger amounts, which are admittedly toxic, are still so small that any cautious man must wonder if it is practicable for him to keep within the safety zone.

Take, for instance, boron. The addition of boron, in the form of the well-known salt borax, is widely advocated. One of the reprints sent me by my critics is of an article written by Dr. Roy A. Bair and published in the March 1948 issue of *The Greenkeepers' Reporter*. Dr. Bair writes:

> "Many of the minor elements are toxic to plants in large amounts, and the word 'large' is a very relative thing. For instance, on sandy soil five pounds of borax (per acre) is a good thing, but ten pounds is apt to yellow plants or become positively poisonous or toxic to the plant."

If we assume that a furrow slice weighs 2,000,000 pounds to the acre (a generally accepted figure), 5 pounds will be equivalent to 2.5 parts per million or 0.00025%. Or, to put it in still another way, 5 pounds of borax would have to be distributed evenly through 1,000 tons of soil. According to Dr. Bair, if the percentage at any point rises to 0.0005, a plant growing in that location will be poisoned.

In my work as a chemist, I have had some experience in trying to obtain even distribution of added materials to various substances; for instance, I have worked with others on the addition of very small amounts of vitamins to granulated sugar. With all the facilities of a laboratory, including mixers of high efficiency, the even distribution of one powder in another is surprisingly difficult to achieve. The even distribution of 0.00025% of borax over an acre of land seems to me impossible of accomplishment by any practical means.

To make matters still more difficult and bewildering, there is a startling difference of opinion among the experts as to what amount of borax is beneficial and what is disastrous. Dr. Bair recommends 5 pounds to the acre on sandy soil and 10 pounds on muck. G. W. Monier Williams, in his recently published book *Trace Elements in Food*, (Wiley) states on page 380 that it has been found that anything over 3 pounds to the acre is toxic to beans, and then adds, on the following page, that boron requirements and sensitivity to it vary

greatly with different plants and different soils. On the other hand, in another pamphlet sent to me, Mr. Lee Vanderlinden, of the Research Department of the Charles H. Lilly Co., Seattle, under the heading of "Special Information," makes the statement: "Less than 60 pounds of boron per acre means deficiency will develop." In view of the figures of 5 to 10 pounds of borax recommended by Dr. Bair, and 3 pounds quoted by Dr. Williams, the amount of boron (which represents a much greater weight of borax) recommended by Mr. Vanderlinden should, perhaps, come under the heading of "Extra Special Information," since any attempt to correct a "deficiency" on such a scale will, according to the views of the first two gentlemen, destroy every plant above ground.

Turning for enlightenment to Dr. Drosdoff in the Department of Agriculture's *Yearbook of Agriculture*, we find him telling us that "the use of more than 20 or 30 pounds of borax to the acre will cause injury to some crops," which seems to leave him exposed to the fire of the other three. He goes on to say: "This narrow range of tolerance, plus the findings of recent research on the influence of the calcium, potassium, phosphate and nitrate ions on boron availability, emphasizes the growing need for attention to the practical aspects of the problem." With that, at least, we can all agree. The need seems to be growing by leaps and bounds.

Similar disparities are found in connection with other trace elements. The Charles H. Lilly Company, still offering its "Special Information," states that "less than 150 pounds of zinc per acre indicates zinc deficiency." Dr. Bair says: "From 10 to 12 pounds to the acre of zinc sulphate, at the most, is required." Dr. Drosdoff quotes no figures. L. G. Willis, in a paper read before The Soil Science Society of America, in 1944, quotes figures showing that C. A. Mooers obtained the biggest yield of beets by using the equivalent of 308 pounds of zinc oxide per acre. Dr. Monier Williams tells us that a dressing of 20 pounds zinc sulphate per acre will cure chlorosis in corn. Well, maybe. I don't have to cure it. I use compost and the corn is green.

In the case of manganese, confusion piles on confusion and produces chaos. There is the same difference of opinion among experts as to what quantities are beneficial and what are harmful, but in the case of this element the differences become staggering. Monier Williams states that manganese deficiency can be remedied in many instances by the application of 15 to 40 pounds of manganese sulphate per acre. Dr. Bair corrected what he believed to be manganese deficiency by spraying on 4 pounds of manganese sulphate per acre. Dr. Twyman of the University of Birmingham (England) reports the growth of barley was retarded when manganese sulphate was used in concentrations greater than 1 to 100,000; this would be approximately 20 pounds per acre; Mr. Vanderlinden says that less than 150 pounds of manganese per acre means a deficiency will develop. But the most astonishing figure of all comes from Mr. Wishhusen, and since he is connected with the Manganese Research and Development Foundation it should be authentic. In an article published in *Agricultural Chemicals* in June, 1947, he wrote:

> "Fertilizer recommendations for 1946 in Michigan include 20 pounds of manganese sulphate per acre on sugar beets wherever soil pH is above 6.9, and 100 pounds for snap beans and radish. For home gardens on alkaline soils, 2 *to* 3 *pounds per* 100 *square feet are recommended.*"

The italics are mine but are quite inadequate for conveying my amazement. Since there are approximately 43,500 square feet in an acre, 2 to 3 pounds per 100 square feet would be equivalent to 870 to 1310 pounds to the acre! My guess is that any home gardener who plunged on manganese

in accordance with Mr. Wischhusen's advice has a soil on which he will find it difficult to raise any kind of crop for several seasons to come.

Mr. Wischhusen evidently felt that some explanation of these varying recommendations was in order. On the following page, under the heading "Manganese Toxicity," he writes:

> "A manganese toxicity cannot be described with the same degree of clarity as a deficiency."

That at least prepares us. Evidently, things are not going to be quite clear. But let us go on:

> "This is largely due to its varied effects upon the assimilation by plants of other elements and upon the bacterial activity in soils, which are largely matters of soil contents and soil reactions."

We're still with him but the fog is beginning to close in. Let us continue:

> "A manganese toxicity may be merely a deficiency of other elements, notably calcium, magnesium, iron, phosphorus."

Let's stop a minute and get this. It must mean that a plant is sick because there is a deficiency of manganese in the soil, so manganese is added to cure the sickness; but then the plant gets a new sickness caused by the manganese; so we have to add calcium, magnesium, iron and phosphorus to cure the sickness caused by the manganese that was added to cure the sickness caused by the deficiency of manganese. You see, it's perfectly clear if we're patient enough to work it out. Or is it? What comes next?

> "A manganese status satisfactory to plant growth depends on a suitable balance between the relative rates of oxidation and reduction."

Oh my! Just when we thought everything was getting clear, the fog closes in worse than ever and we can't see a thing in any direction. Let's skip that one and see if the final sentence of this difficult paragraph will lead us back to a clearer atmosphere :

> "The concentrations of soluble manganese toxic to plants, therefore, fluctuate with various conditions."

Yes, yes; we can see that all right. But won't Mr. Wischhusen tell us how to obtain that manganese status satisfactory to plant growth in *our* soil? We might be able to arrange that business of the assimilation of other elements and the bacterial activity of the soil, but how do we get a suitable balance between the relative rates of oxidation and reduction? What *is* a suitable balance between the relative rates of oxidation and reduction?

Let's stop being frivolous and ask a serious question. Why are our soil scientists involving themselves and us in these fantastic complexities when they admit that all the difficulties can be solved by abandoning the use of commercial fertilizers and going back to manures and composts? Incredible though it may seem, in this same article, on the page previous to the one from which I have been quoting, there occur the following words:

> "Wherever sufficient manure is available for fertilizer purposes, an acute manganese deficiency may never be experienced."

On his own admission, then, if Mr. Wischhusen persuaded a farmer to fertilize his fields with manure instead of commercial fertilizers, that farmer would have no trouble with either deficiency or toxicity of manganese. But so hypnotized is he by the theories connected with trace elements that he can solemnly consider offering the farmer information in the involved language quoted above and to supplement this with a series of numbered paragraphs which he calls by the rather strange name of "empirical criteriae." From them I quote Number 5:

> "The manganous-manganic equilibrium of soils is important. In alkaline soil at least three parts

per million of exchangeable manganese must be present for satisfactory crop production In order to maintain an adequate level of the exchangeable fraction, this must be supplemented by at least 100 parts per million of easily reducible manganese. In acid soils, the optimum level of exchangeable manganese can be much lower with the amount depending on the level of acidity."

I will not comment further. I leave my readers to picture the reaction of a farmer who has sought advice on the treatment of the soil of his 1,000 acre farm and has been handed information such as the above.

The simple truth is that while hundreds of soil experts of high, medium and low repute are eager to tell you that traces of boron, zinc, manganese, copper, iodine and other elements must be present in your soil if you wish to produce satisfactory crops, there is not one of them who can quote a figure, with which all the rest will agree, telling you the maximum amount you dare use if your plants are to remain alive.

This is the Second of a series of five articles.

Apple Pomace

Apple pomace decays readily if mixed with material that provides for proper aeration. Its value in the wet state is not high, since the nitrogen content is only one fifth of one per cent. But when analysing the ash content of apple skins, it appeared that they had over 3 per cent phosphoric acid. Since apple pomace can be had in quantities, a goodly amount of phosphoric acid may be obtained from it at the cost of the hauling. The potash content is, of course, much higher, amounting to about 12 per cent of the ash, which corresponds to ¾ of one per cent of the pomace. It would seem best to use apple pomace for mulching in the orchard whenever feasible, possibly mixed with straw to permit penetration of air.

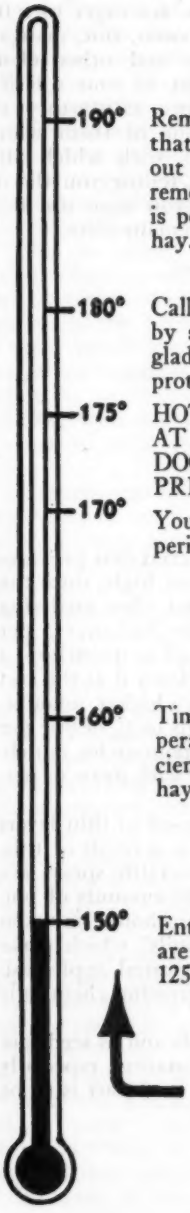
In the compost heap, apple pomace should be used in thin layers because heavy layers tend to become compact and, as a result of this, fail to break down. When heavy applications of metallic sprays are used, the apple skins may contain not inconsiderable amounts of poison residues that will in time endanger the soil. Care should be taken to prevent the frmoation of those "toxic orchard soils" which make future growing of food crops impossible. Heavily sprayed apple residues had best not be used for food crops, but for growing chemurgic crops.

As apple pomace contains large amounts of seeds and as seeds are storage organs which contain valuable nutritive substances, especially phosphorus and nitrogen, the fertilizer value of the seed part is to be considered too as of value to organic farming.

YOUR HAYMOW IS A FI

By W. C. Harrington

Extension Agricultural Engineer
Massachusetts State College



190° Remove hay rapidly to safe distance. While there is evidence that hay may heat to a point several degrees above 200 without ignition, the dictates of caution and safety require its removal under suitable fire department protection if this aid is possible. Remove animals and tools before touching the hay. Better to take precautions than to suffer loss.*

180° Call your fire chief and make immediate provision for standby service. Also notify your insurance agent, who will be glad to cooperate and may make arrangements for additional protective service.

175° HOT SPOTS OR POCKETS MAY BE ANTICIPATED AT 175 DEGREES. ABOVE THIS POINT KEEP ALL DOORS AND OTHER OPENINGS CLOSED SO AS TO PREVENT THE FORMATION OF DRAFTS.

170° You must maintain constant vigilance and take temperatures periodically, looking for possible hot spots.

160° Time for you to take notice. If you have an automatic temperature alarm, it will sound at this point, giving you sufficient time to make necessary preparations for removing the hay—if you act promptly.

150° Entering the Danger Zone. Up to this point, temperatures are not to be considered abnormal, although anything above 125 degrees is unusual.

READ UP

* WARNING—Mows that have heated to a considerable degree are dangerous to walk on as the workman may drop into a burning pocket. If necessary to enter the mow, long planks must be used. Help should be on hand in case of accident.

S A FIRE TRAP

HAY, particularly leguminous varieties, if incompletely cured at the time of storage—that is, having a moisture content of over 25 to 30 per cent—is subject to spontaneous ignition.

Leguminous varieties such as alfalfa, clover, and vetch require more care in curing than do some grasses such as timothy. Because of the speeding up of haying operations due to improved machinery there is a tendency to store hay more quickly than formerly. Partially cured hay is more apt to heat in large mows than in small ones. Mows should be well ventilated. Leaky roofs, damp floors, or rain coming through open windows or doors may also cause heating of hay.

First cuttings must be well cured. If at the bottom of the mow and tightly packed, little opportunity is afforded for further curing.

Rowen deserves careful attention. It is often harvested when the dews are heavy and the days short, so less field curing may be done. Moreover, rowen has a tendency to pack tight in the mow, preventing ventilation.

Chopped hay which is to be blown into the barn should be cured even more carefully than long hay, for almost twice as much will be placed in the same sized mow.

Hay wet by rain requires unusual care at it generally considered more susceptible to spontaneous ignition than normally cured hay.

Oats cut before maturity or wet by rain are dangerous and should not be stored unless well cured.

Determination of Moisture Content

One practical method used by farmers to test for moisture is to twist a wisp of hay in the hands. If the twisted hay is tough and there is evidence of moisture where the stems are broken, the hay is considered too sappy for safe storage. If the stems are slightly brittle when broken and there is no evidence of moisture when the stems are twisted, the hay can be stored without danger of spoilage. Another method is to scrape the outside of the stems with the fingernail. If the epidermis can be peeled from the stem, the hay is considered undercured. If it does not peel off, the hay is dry enough to stack or put in the mow. (Misc. Pub. No. 363 "Hay Quality," U. S. D. A.)

Salted Hay

Salting of hay, although long considered helpful, cannot be relied upon as a safeguard against spontaneous ignition, and it should not be considered a substitute for sufficient curing of hay in the fields.

Temperatures in Hay Mows

Where hot spots are suspected, they may be located definitely by means of a thermometer probe that can be made at home. A glass thermometer with a range up to at least 2212 Fahr. is imbedded in a groove cut in the side and near one end of a wooden rod about three-fourths of an inch square. The thermometer is held in the groove by several turns of electrician's tape. The end of the stick below the thermometer is sharpened.

A fairly accurate measure of the temperature at different points in the hay can be obtained by forcing the probe into the hay, leaving it for a minute or two, then quickly withdrawing it and reading the thermometer. One danger in doing this is that the hole made by the probe forms a duct through which the air can readily enter the hay. The probe should be used at but a few definite places and always in the same hole, and a similar sized stick should fill the hole between readings. If the temperature becomes excessively high and readings are discontinued, the holes should be plugged.

Memos To Farmers . . . .

Manure Loses Value Rapidly If Not Plowed In

Here is something that may make you think twice if you are in the habit of spreading manure. The book, *Irrigated Soils, Their Fertility and Management,* reviewed in this issue, quotes the results of an interesting experiment.

Manure was spread on many experimental plots and plowed under at different times. The effect of the varying exposure to air and sun of the manure was then measured by growing crops on the different plots. It was found that if manure was allowed to lay on the surface for six hours before being plowed under, it lost 15 per cent of its effectiveness. Thirty per cent was lost when the manure laid 24 hours before being plowed under. If it remained on top for four days, over forty per cent of its effectiveness was lost.

The results of this experiment emphasize the importance of disking in manure when sheet composting. Covering it with a mulch will also preserve its moisture and protect it from the sun.

The Italian method may yet prove to be the most efficient way to handle manure. When this method is used the manure is placed in an almost air tight bin, allowing anaerobic instead of aerobic bacteria to decompose the manure. The manure is protected from the elements while decomposition is taking place. When it has turned into compost it can be plowed in right away.

Garbage To Be Composted In Allentown, Pennsylvania

The Pennsylvania industrial city of Allentown was all set to spend almost a million dollars for a new incinerator. The old incinerator was burning up garbage at a fantastic rate, but it could not keep up with the increasing large quantities of waste being thrown away by local households.

Marshall Smith, a New York engineer, and J. I. Rodale, editor of *Organic Gardening* and *The Organic Farmer,* realized that the entire expenditure for a new incinerator could be saved by converting the garbage to compost. It was no trouble at all to convince the Allentown city council of the feasability of experimenting with composting as a means of converting the garbage.

The only equipment Smith plans to utilize is a grinder to break up the garbage as it comes in and a shed to protect it from the weather. He is now running an experiment in Allentown to iron the kinks out of the process. By inoculating the garbage with bacteria the composting time has been reduced to eight days.

Eventually, Marshall Smith plans to form a corporation and compost the garbage of cities all over the country. The finished compost in Allentown will be sold to nearby farmers, and the city will actually be paid for a waste formerly worth less than nothing.

1950 Economic Outlook Is Not Dark

Despite the fact that the farmers of this country are overproducing, there is little chance that there will be a serious reduction of farm prices and demand for farm products next year. Market quotas and acreage allotments will be instituted to bolster prices. Early estimates of the corn crop were considerably higher than

The potato thrower in this picture is risking rupture, one of the most serious threats to the farmer's health, every time he picks up a basket. Think twice and take your time before lifting heavy weights. Make sure your weight is balanced on both your feet and try to lift with your body instead of your hands.

Weight lifting is not the only cause of rupture. A fellow I know ruptured himself as he was reaching to prune a high branch. I have also heard tell of a man who was ruptured as he turned over in bed.

recent estimates, and it is predicted that the problem of keeping up the price of corn will not be as difficult as expected.

The average of the prices for all farm products may fall below the parity level for the first time since 1941. Net income of farmers may be cut to the level of 1945, but even so, the net income for 1950 would be more than double the prewar average level and equal to the average of the war years.

Next year will be an excellent time for more farmers to begin programs of Organic fertilization. Since overproduction will encourage more fallow acreage, next spring will be an economically advantageous time to give some of your fields a rest and to start applying organic residues.

Henry Wallace Visits Experimental Farm

Henry A. Wallace, a man familiar to all agriculturists, visited the Organic Experimental Farm on November 10th. Mr. Wallace has been, within the last decade, the Vice President of the United States, Secretary of Agriculture, Secretary of Commerce and the 1948 Progressive Party presidential candidate.

Acting as a farmer, not a politician,

Wallace professed sympathy with Organic principles. He was impressed by the disease-free odorless chicken house on the experimental farm and dug his hands deep into several piles of compost to compare quality. Mrs. Wallace took home a few earthworms to start a colony on their Connecticut farm.

"In the 1960's," stated Wallace, "American soil scientists will realize that a great many of their problems have been caused by a lack of organic matter in the soil. They will then concentrate their efforts on increasing the organic matter content of soils."

This is an important and far reaching remark, especially since it was made by a former secretary of agriculture.

Famous Negro Agronomist Boosted Large-Scale Composting

While going through a pile of old experiment station bulletins the other day I came upon one by the late George Washington Carver, the Negro agriculturist who is responsible for the present economic prominence of the peanut and the sweet potato. In this little pamphlet, entitled "How to Build Up and Maintain the Virgin Fertility of Our Soil," Dr. Carver advises the farmer to make compost of any organic material available.

"Make your own fertilizer on the farm," he says. "Buy as little as possible. A year-round compost pile is absolutely essential and can be had with little labor and practically no cash outlay."

Dr. Carver also stressed the importance of covering the heap to prevent the leaching away of nutrients by rain.

"It is easy to see," explains Dr. Carver, "that our farm animals are great fertilizer factories, turning out the cheapest and best known product for the permanent building up of the soil. In addition to this farmyard manure, there are also many thousands of tons of the finest fertilizer going to waste all over the South, in the form of decaying leaves of the forest and the rich sediment of the swamp, known as 'muck.' Every idle moment should be put in gathering up these fertilizers."

Orchardist Reports Success Of Natural Fruit Culture

E. Stuart Hubbard of Poughkeepsie, N. Y., recently related to the Quebec Pomological and Fruit Growing Society the success of his naturally treated orchard.

"It seems best to spend available money for brought-in organic materials," he explained, "rather than for tillage, which would burn up humus, or for inorganic fertilizers which would not add to the organic supply and which were observed to be giving less satisfactory results in many orchards."

"The results are becoming most gratifying," Mr. Hubbard reports. "Tree twigs are shorter and thicker, fruit spurs plentiful and strong, crops regular without excessive sets, fruits firm but crisp, of good size, color full red with creamy background, flavor outstanding, dropping normal on McIntosh with keeping quality excellent.

"There is also a marked resistance to apple scab and near immunity to epidemic attacks of mites and spiders, fire blight, red bug, leaf hopper and aphids where routine control measures are used."

This report from a sensibly handled orchard contrasts greatly to news of increasing trouble in chemicalized orchards with pests, poor yields and diseased fruit.

Organic Matter Stimulates Volcanic Ash

Almost any farmer will tell you that it is almost impossible to grow crops in volcanic ash. (Ash is a misnomer. As there is no fire in a volcano, the "ash" is merely fine particles of once-molten rock.) The Arizona Farmer recently reported the case of a man who has done just that.

Tom Marlar operates a farm in an isolated section of northern Arizona. His soil, up until last year, was 100 per cent volcanic ash—a grayish lava that was so powdery that when you

broke a lump of it in your hand it turned into a fine sooty dust. Rain formed an impervius layer on the surface and water ran right off.

The first few crops Marlar tried to raise on this land failed miserably. Then he tried growing a cover crop during the wet season. He supplied organic matter by disking in the successful cover crop and he planted oats under the surface mulch. That summer he had a cash crop for the first time.

Many Insecticides Worse Than DDT

DDT has been publicized as a deadly killer. It is, no doubt about that. However, it is a piker when compared to some other well known pesticides.

Nicotine Sulfate (Black Leaf 40) is 25 times as toxic as DDT. Parathion, a prime aphid and orchard mite eradicator, is 75 times as toxic as DDT. Another new material, Tetraethyl pyrophosphate (TEPP) is 125 times as toxic.

It takes about a cupful of DDT to kill a person, while minute quantities have a cumulatively harmful effect. However, much smaller quantities of arsenic will kill human beings and arsenic has been in use for years.

The Organic Farmer seldom realizes how lucky he is not to have to bother with insecticides. Now-a-days the chemical farmer must have a B. S. in chemistry plus a working knowledge of entomology.

—R. R.

Lignin

When you smell the aromatic richness of freshly plowed ground, you smell humus. Its main constituent is, from all indications, lignin which forms aromatic compounds as it breaks down. Lignin is rather stable and stays in the ground for a long time. It is a main part of wood, in which it works as a stiffening agent to cellulose. Some pines contain as much as 30 per cent lignin in their wood, and you may have come across it yourself when encountering a hard bit inside a pear or when eating a radish that has become "woody." Twelve million tons of lignin collect every year from the wood-working industries and could be used as a filler by the chemical industries or as a litter by the dairy farmers. Experiments at the University of New Hampshire showed that the addition of lignin to the seed bed produced a better and greener growth. Where available, it should be used for compost-making and in mulches. The lignin content of cornstalks is 11 per cent, that of oak leaves 30 per cent, of old pine needles 23 per cent, and of dry alfalfa plants 11 per cent. A forest humus has about 48 per cent lignin in it. Dr. Wolf, formerly with the New Jersey Experiment Station, now with Seabrook Farms, suggests that 2½ to 5 tons of lignin should be incorporated per acre of land to supply more organic matter, as Dr. Aries of *Northeastern Wood Utilization Council,* Orono, Maine, reports.

Report From England

The Further Progress of an Organic Farm

By Friend Sykes

Some distinguished visitors from Sweden said recently, on their visit to this farm, that 'The eyes of the world—friends and foes alike—are on Chanty.'

The significance of this observation will be understood when it is realized that every year 2,000 visitors journey to this Mecca of humus farming. Many have already been here once, twice or thrice before. They are observing and noting the progress, if any, which the writing on the land sets forth; for better or for worse, the account of our husbandry is there on record.

It is now well known that this land was for the most part in very poor heart when we began. The 10,000 rabbits which were killed in our first year were so poor that they could not be marketed locally, and our workmen refused to take them home for their own consumption. Today the Chanty acres are growing some of the heaviest crops to be found anywhere in Britain, including the richest lands in Lincolnshire, the Lothians or anywhere else. Our grasslands, too, are always the subject of comment, since bullocks and sheep are sold from them direct to the butcher, while cows milk well and keep up their yields on grass alone.

But this is not all. In the early days, when a heavy tonnage of foods had to be brought in from outside to keep alive the cattle with which we started, we had many diseases. Tuberculosis, mastitis, contagious abortion, Johnes' disease, were all-too-familiar aquaintances. Touching wood as I write, and in a spirit of thankfulness rather than of vain boasting, it is pleasing to be able to note that these appear to be things of the past. We are apparently proving that our heavy crops of grass, cereals, and roots are also crops of high guality; for the life-substaining character of the foods the cattle are consuming has built up to so exalted a standard of health that disease no longer dogs our steps, either in crops or in livestock. As each year goes by, visitors remark upon the noticeable improvement in our stock, as well as on its exceptionally high standard.

We believe that a contributory factor is the mixed character of our grazing management. Too many horses make land horse-sick; too many cows, cow-sick; and the same applies to sheep and poultry. But if these different species are allowed to graze together, or in sequence, sickness ceases to be evident. We have at Chanty five distinct kinds of livestock—Guernsey dairy cattle (attested), Galloway beef cattle, Half-bred ewes crossed with a Suffolk ram, a flock of poultry and some 18 Thoroughbred horses.

Somewhat similarly, we have got away from excessive simplicity of our pastures. It has been believed for gen-

erations that the one-year mixture of clover and ryegrass was a sound feature of the Norfolk four-course husbandry evolved by Coke of Holkham and Townsend of Raynham. But our opinion is that it has very little to recommend it, and that a large variety of grasses and legumes is as necessary as a large variety of livestock. Our own pastures approximate to the following mixture:

Cocksfoot	5
Perennial ryegrass	5
Italian ryegrass	1
Timothy	3
Rough-stalked meadow-grass	1
Crested dogtail	1
White clover, Aberystwyh S.100	1
Late-flowering red clover	3
Alsyke	1
Alfalfa	3
American sweet clover	3
Sainfoin, common milled	10
Burnet	3
Chicory	2
Yarrow	½
Total, per acre,	42½ lb.

The high proportion of deep-rooting species in our pastures will be noted. These act in several capacities. They are, for instance, Nature's own sub-soilers, going down deep into the bowels of the earth for minerals and trace elements which may not be available in the top-soil. If the subsoil is limestone, they bring up calcium into the top-soil, thus neutralizing the natural accumulation of acidity. They improve, too, the natural drainage, giving sour accumulations of moisture easy access to deeper layers and so sweetening the top six inches. Most important of all, they provide an interesting and varied diet, which shows itself in the contentment of the cattle, their bloom of coat and their general well-being.

As the minerals from the subsoil pass through the animals and are voided in dung and urine, they are brought into circulation in the top few inches of soil. By employing these means, there need never be such a thing as a shortage of mineral plant foods.

It will be seen that the simple one-year pasture of clover and ryegrass failed completely to achieve any of these objects, first, because both species are shallow-rooted, second, because its duration was too short. It was, too, almost invariably cut for hay, making yet another crop removed from the land under the old Norfolk four-course system.

It is true, of course, that an essential feature of that system used to be a heavy dressing every four years of manure made by yarded bullocks from the straw of the cereal crops. Turnips for sheep-folding were also an integral part of the fertility scheme. It is a matter of regret to all students of agricultural history that there are no written records, supported by photographic evidence, from which we might have been able to ascertain just how effective this four-course system was. For during the last hundred years, and especially during the last twenty-five, artificial fertilizers have been used in increasing quantities, so that any assessment of the parts played respectively by the good old-fashioned dung and by the artificials is extraordinarily difficult.

It is indeed frequently asserted that, rather than helping in the permanent fertilizing of the soil, the fertilizers set it back; but the case is not officially proven. Those of us, however, who have been farming long enough to have proved it, do know to our own satsisfaction that a regular supply of dung—or, alternatively, of the humus made by the sheet-compost of the four-year pasture—adds to the permanent fertility of the land. We have proved it over the last thirteen years at Chantry, where there is no comparison between the land as it was and as it is now. But we were already fully satisfied with it years before we came here, having proved it at Richings in Buckinghamshire. We have no doubt whatever that if the good of the land and its lasting fertility is the farmer's objective—and, after all, these are his capital assets—the only way to farm is with humus.

Humus Farming for Profit

We would like to remind readers that we are no dilettante farmers. We are not in reciept of any princely income from some industrial investment, taxed at 19 shillings to the pound, yet enabled, owing to the ridiculous incidence of taxation under the present Finance Act, to farm at a considerable loss and still add enormously to our capital resources. Our only source of livelihood is farming, and we are actuated, not by alruism, but by a much more mundane motive, namely, the making of the greatest profit which our capabilities can achieve.

We have been farming long enough to have tested manure and artificials as against humus alone, and we know that the latter provides us with a better profit than any other system we have tried. Because of this, and this alone, we shall continue to be humus farmers. Are there farmers anywhere in the world who can afford to plan their farming program from any angle but that of profit?

I seem unwittingly to have given the impression, in *Humus and the Farmer,* that I am possessed of the noblest of motives. I hope I am not entirely without such motives, but I beg my readers to grasp the fact that the stern economics of farming compel me to farm for profit first, last. and all the time. If the world at large can be made to realize that by farming with humus, and with humus alone, profit will result, there will be a greater chance of humus farming becoming the accepted method of husbandry. All talk of 'the good ot the land' is sheer waste of time if it is dissociated from legitimate profit.

It is impossible in the space of this article to include everything bearing on this point; but a few convincing facts may, nevertheless, support my claims. An example is our yield of milk, which, with the same number of cows in milk, was 8,000 gallons more in 1948 than in 1947, while the butterfat and solids-not-fat were 5 per cent higher. At 3 shillings a gallon, without any additional production costs, such an increase would seem to suggest a further 1,200 pounds per annum profit as a result of using humus-grown foods. When I mentioned this interesting fact in one of my lectures last winter, a cynical listener pointed out that 1948 was a consistenly wet and drippy year, when grass flourished, and that much of our increased yield might be attributed to the season. But we keep records every year, and we find that our 1949 yield shows a further useful increase, both in gallonage and in quality, over 1948. In 1949, we have had a drought, the like of which I do not remember since 1921; so I cannot help wondering to what my cynical friend will attribute this further rise in output

Good Farming Means Continuity

This increasing output, year by year for twelve years without a check, is one of the pleasing features of humus farming. Although we have had drought to contend with, our grass and cereals, this year are the heaviest crops we have ever had. Yet farmers through this neighborhood, and in fact, throughout England more or less, have been complaining of the lightness of their hay crop, the short straw of their cereals, and the general lack of growth. One of the most valuable characteristics of humus is its physical quality of retaining moisture, and in a dry season like this that virtue stands out at Chantry for all to see.

Good farming can be discribed in a single word—continuity. If a farmer is to continue in his occupation, in every sense of the word, he must not only grow good crops, but continue growing them: not merely having a burst of health in his livestock. but maintaining an exalted standard of health year by year: being as free as possible of any need to buy seeds from outside sources: and getting crops high both in output and in vigour, with increasing freedom from disease.

When I speak of reproduction, I

mean reproduction of every species we grow on the farm, both crops and livestock. One of the great problems of today is the serious increase in sterility in all kinds of stock. Among thoroughbreds, some 33 to 40 percent of mares are recorded as barren each year; cows are becoming increasingly non-procreative. Records at Chantry are illuminating. This year, we had six mares at stud, all in foal; in sheep, we have averaged two lambs to a ewe for the whole flock; in our large herd of Guernseys, nearly 100 per cent are breeding. There could be no better evidence of the soundness of good husbandry. Herein, moreover, lies a source of much improved profits for the farmer; for if he has to carry, say, one-third of his livestock as non-producers, his income is seriously affected, while veterinary bills become a substantial outgoing.

Sheet-Composting the Main Method

I should like here to correct another impression which *Humus and the Farmer* seems to have created That book covers a great variety of subjects, *one* of which is compost. This I discuss at considerable length, owing to its great importance. But I have tried repeatedly to make it clear than at Chantry the practical method by which we build up humus is the complex, deep-rooted, four-year pasture, and its management by grazing with mixed livestock. I estimate that there are deposited during the four years, at least 25 tons of dung and urine per acre. So heavy is this dressing that one must then plough, so as to use it as an activator for reducing the sod to humus. The humus then feeds the population of the soil, so that this unpaid ladour force can multipy in untold numbers, working on the minerals which, in their complex natural state, are unavailable as plant foods. Further, as the micro-organisms die, their decomposing bodies provide just the kind of food the green plant needs.

At the end of four-years as the book points out, the bank of organic fertilizer is sufficient to grow three heavy cereal crops. But these crops have created another problem for me —a considerable tonnage of straw to be decomposed. It is taken into our stockyards and made into muck in the old-fashioned way. We then try to make a systematic collection of all the waste vegetation on the farm—roadside cuttings, hedge trimmings, ditch cleaning, bracken, waste leaves. This is mechanically mixed with the muck, and in the course of a year we sometimes make 1,000 tons of compost.

Unfortunately, however, the economy of the farm, with restricted labour, stops us from making anything like the tonnage of this invaluable material that we should like to use. It is clear that 1,000 tons a year, spread at the rate of 20 tons to an acre, will cover only 50 acres a year; and since we have 750 acres, it would take 15 years to go around the farm.

I would, therefore, again emphasize this fundamental point which applies to all farms, namely, that the only way in which the humus content of the land can economically be built up, partly because of cost, partly for lack of labour, partly because sufficient material for heap-compost is seldom available, is by means of the all-important, deep-rooting, four-year pasture.

Editor's note—Friend Sykes is the author of the book HUMUS AND THE FARMER, *sold by The Organic Farmer for* $4.50.

The pasture mixture suggested by Mr. Sykes is not recommended as being entirely suitable for this country. Climatic conditions in England and the United States vary greatly. Write to your state experiment station for a four year mixture for your area.

Mulches for Orchard Soils

By M. B. Cummings
Vermont Nursery Inspector

THE perpetual problem in orchards is to maintain the organic content of soils. It is used up and needs annually to be replenished. To the fruit grower, whether large or small his operations, nothing in practice can exceed in importance the nature and content of his soil. The more successful he is in this matter, the greater his success in growing good fruit and doing it economically. One may do more or less pruning, more or less fruit thinning, etc., but he should not be stinting in supplying organic material for it is the very life and the dynamic center of the land. It is the basis of healthy, vigorous and productive fruit trees.

Fruit and Forest Trees

A tree in the orchard is somewhat like a tree in the woods, a large permanent specimen, but its needs are much greater, for in addition to wood production it should yield an annual crop of fruit. This gives the orchard tree a double function in contrast to a single one for the forest tree. A fruit tree needs ample growth of wood for the formation of new branches, to develop fruit spurs and fruit buds. These must precede fruit development. The growing and maturing of a crop of fruit makes a heavy draft on the stored and accumulating food materials. A forest tree gets its litter of leaves, which may be ample, but an orchard needs offside and additional material for its double duty, wood and fruit. Dead vegetation helps the land.

Changes in Soil Treatment

In the beginning of fruit growing years ago trees were grown in grassland—sometimes in pastures. Grass was allowed to grow, was cut as hay and hauled away. This method deprived the trees of needed organic matter and the results were generally meager and the crop irregular in the early days. Then there was a long period of clean cultivation with or without cover crops, preferably the former. After this stage there was another period in which the practice called for the application of manure. The latter is still a good practice, in fact one of the best. And finally the mulch system which is the best practice of all. And yet only a few practitioners know its value.

Mulching

This term means the introduction of organic matter into the orchard and its placement upon the soil as a cover, more especially under the tree and under the outer branches, and less near the trunk. This method is almost ideal from the standpoint of maintaining the organic matter, preventing erosion where sloping land exists, and in maintaining the fertility of the soil. It also helps greatly in unifying the moisture content and its temperature. Both of these results are important. Moreover, the mulch insures the penetration of rain-fall and hinders the washing of the soil and its solutes. When the mulch material is hauled in, it does not compete while growing with the fruit trees in

their need for moisture and nutrients in the orchard. Under this practice the mulch should be sufficient to suppress the growth of weeds and grass under the trees. If the mulch or manure is ample to cover all the ground between trees, so much the better, as there is then more water and nutrients for the trees. The orchard tree also gets the benefit of the introduced product and in addition the benefit from the soil just as before the application of the mulch.

Two objections have been made to the mulching practice. One is the fire hazard in a dry season. Another is the rodent problem as the mulch seems to afford shelter and breeding medium for mice. But with proper precaution these hazards are not insurmountable, in fact they are overcome in a well ordered orchard.

Source Material

The mulching material may have many sources according to its nature. Swale hay is good and generally inexpensive to get; leaves from the woods or from city street sweepings serve well. Sawdust is sometimes handy and generally effective. However, it tends to make the soil acid. Lime should be mixed with a sawdust mulch. Straw or waste hay have been used. Bluegrass is much used. It is, however, less desirable for dry places. Pea vine is also excellent. Buckwheat or other straw will do. Orchard grass is excellent and is sometimes grown in the orchard between the rows of trees and is cut just before seeding and placed under the branches. Buckwheat hulls and cotton seed meal make fair mulches where available at low total cost including haulage and distribution.

The writer has had many years' experience with orchard grass and street leaves, and found them good mulching products. Orchard grass (Dactylis glomerata) is a permanent grass. It makes a good growth and forms fine sod even though tufted, and yields well year after year. It was used at the Vermont Experiment Station for twenty years and was as good after two decades as at the beginning. It was grown between the rows and when cut spread mostly under the trees. In years of abundant rain two cuttings were made—one in mid-June, another in mid-August. Orchard grass grows well in slightly acid soil, is very hardy and stands dry summer weather.

GAL. 3 orchard soils OF dec

Leaves and Silage

Leaves were used for several years. They were available in large quantities as the orchard was within the city limits and the street department delivered them to the orchard free of charge as the nearest dumping place for the city trucks. For several years leaves were placed one foot deep under the branches and packed to some extent by tramping; but often after the first good rain, the material packed itself and stayed where placed. Leaves were then used for three consecutive years, and they were satisfactory. Dooryard leaves can be used for the family orchard which is a good disposal for them. After the first year the leaves decay at the bottom of the mulch fast enough to permit annual applications to be put on top. They settle fast.

Silage was used one year. A fire in the dairy barn destroyed the silo and a part of its contents. To make the insurance good on the fire the silage had to be discarded. It was carted to the orchard and used as a mulch under apple trees. It worked well. The product was fine.

In texture, it packed well under the tree and decayed in due time, it served as a mulch rendering the same benefits as any other product. The second year after the heavy leaf mulch in one part of the orchard and the heavy silage mulch in the other portion, there came the largest apple crop in forty years. Other orchard practices were the same as in previous and successive years. The generous mulches were definitely associated with heavy bearing.

Livestock

Dairy Bulls Are Dangerous

No dairy bull is safe, regardless of how gentle he seems to be. The so-called gentle bull is too often the one which acts at unexpected moments, gores someone to death, or inflicts serious injury.

One of the principal rules with bulls is to handle them as little as possible. With a well-constructed bull pen, any bull can be cared for safely. The gates and doors, as well as facilities for feeding, watering and breeding, can be arranged so that there is no need for the caretaker to expose himself to attack.

Bulls should be ringed at an early age, and worn or weakened rings should be replaced promptly. When it is necessary to lead a bull, always use a staff.

Bulls are not the only livestock on the farm to be handled with care. According to the records of the National Safety Council, horses were responsible for more farm deaths and injuries last year than any other class of livestock. Horses and mules were exceeded only by autos and trucks among the specific agents causing farm accidents. They accounted for seven per cent of all farm accidents, and horses were responsible for by far the greatest proportion of this total.

Cows and steers accounted for three per cent of all farm accidents. Kickings caused the most accidents involving cows and steers.

Wire Is A Hidden Enemy In Cow Pasture

To permit wire and staples to remain in pastures following fence repair or where forage is to be gathered for silage or hay may seriously impair health and production, or cause the death of a valuable animal.

Maintaing woven fences around pasture fields for cattle is expensive and usually a necessary evil. Recently a stretch of old woven wire fence, 13 rods long, was replaced with a new fence after it failed to turn cattle. Before the new fence was put up, a 36 inch portable magnet was attached to a small two wheeled cart and passed over this fence row three times. Two pounds of old broken wire and staples were removed from this area, emphasizing the important job a large magnet can do on livestock farms. Short grass will make such a magnet more successful, however.

Only Clean Cows Give Good Milk

It takes clean cows to produce good milk.

An occasional haircut for bossy will not only keep a lot of dirt from getting into the milk pail, but it will put more dollars in the dairyman's pocket. Clipping cows will improve the quality of the milk. In addition, it cuts down on the time to clean the dairy animal and get her ready for milking.

Mud and dirt around the farm in fall and winter get on the cow when she lies down. Millions of bacteria collect on this foreign matter and cling to the long hairs of the cow.

A systematic clipping program around the flanks, udder, and tail, will prevent a lot of dirt and bacteria from getting on the cow's body in the first place. As a result of the sediment-free milk, bacterial count will be lower, flavor better, and there will be a substantial increase in the milk's quality.

Here is a type of range shelter rarely seen in this country, but quite common in England. The moveable shelter itself fences in a section of the range. Every day it is rolled to a spot of fresh grass.

Poultry

Save Labor In Your Poultry House

Why clean poultry houses over a dozen times a year when it isn't necessary? That is, it won't be necessary if you start a deep litter program now. Poultry houses won't be needing a complete cleaning then again till next fall. Except, of course, for nests, windows, and roosts which need periodical attention.

Litter must be dry to be comfortable. Good ventilation will assure that. Other ways of keeping litter dry are to remove the droppings and damp litter from around the waterers and mash feeders.

All poultrymen should have that litter about eight inches thick before cold weather sets in. Then fork the litter up in piles during the cold weather so the chickens can spread it over the floor. Deep litter heats to some extent. It's this drying effect that will help compensate for the general dampness in chicken coops during the wintertime.

Green Hay Helps Pullet Pecking

Sometimes, pullets can't keep out of mischief when they'er brought in from outside and housed for the fall and winter. They peck each other and the result may be cannibalism, a habit which is hard to break.

Part of the trouble comes from the bird not having enough to do. Crowded conditions in the poultry house and lack of nesting space may encourage the habit.

You can help to prevent the habit from getting started by hanging up some alfalfa or clover hay, or other green feed, for the birds to work on. This keeps them busy while they are getting used to being cooped up in the laying house.

Books . . .

An Inside Look at Soviet Agriculture

THE SOCIALIZED AGRICULTURE OF THE USSR, Naum Jasny, Stanford University Press, $7.50.

It is not often that a book written in a technical vein for the technical worker is capable of holding the interest of the average reader. Usually, such books are masses of incomprehensible statistics and scientific language.

The Socialized Agriculture of the USSR is a technical, statistic-laden volume. However, the theme is of such timely interest and the facts are so pertinent that almost any reader will enjoy it.

Mr. Jasny, himself a Russian, writes with a thorough knowledge of the Russian economic system. Until about 1933 he was connected with the Russian equivalent of the Department of Agriculture.

There are no startling revelations in Mr. Jasny's book. Almost all the material was gleaned from previously published material. Although the author's job of collecting and correlating is an admirable one, it is his anecdotes and personal comments that make the book interesting. American farmers may be amazed to know that Russian farmers usually milk their cows three to four times daily, averaging much less milk than in the U. S.

The insight into the socialized agriculture of the USSR is also extremely enlightening. He says, "The elimination of rotations was one of the backward steps that resulted from the socialization of agriculture. Even such crops as sugar beets have been grown in the same land year after year where rotation had been a well established practice long before collectivization."

Although Mr. Jasny claims that the purpose of his book is not to form in the reader a set opinion on socialized agriculture, he succeeds in building up a strong case against it. "Socialized agriculture failed to produce either abundantly or cheaply," he states. "After an initial severe setback in the early thirties, which brought death to millions and extreme suffering throughout the country, agricultural production finally exceeded the pre-collectivization level in 1937."

The greatest barrier to the spread of communism in Russia after the Revolution was the capitalistic sentiment of the peasants. They were satisfied with life on their small, independent farms. Lenin tried to stop the trend toward forced collectivization. In 1919, Mr. Jasny points out, Lenin said, "There is nothing more stupid than the idea of compulsion with reference to economic relations with average peasants." However, as collectivization of agriculture was the basis for Russian communism, force was necessarily used.

Mr. Jasny claims that the Russian farmer is opposed to another evil, chemical fertilizers. "There are indications," he states, "of unwillingness of the *Kolkhozy* (collective farmers) in certain areas to use the prescribed quantities of commercial fertilizer."

IRRIGATED SOILS, THEIR FERTILITY AND MANAGEMENT, D. W. Thorne, Ph.D. and H. B. Peterson, Ph.D., The Blakiston Company, $5.00.

Irrigated Soils, Their Fertility and Management is an unusual book. Unlike most semi-technical books of interest to only segments of the population, it is well written and well designed. The large type and clear illustrations are further aids to the enjoyment of this book.

Irrigation farmers are not the only tillers of the soil who should be interested in this book. Many, in fact most, portions of it are of general interest. There are chapters on the control of the physical properties of soil, control of the biological properties of soil, maintaining organic matter in soil, minerals and plant growth and other generalized but important phases of farming.

Chapter 15, entitled Control of the Physical Properties of Soil, contains much evidence to support Organic theories of insect and disease control. The authors say, "Many of the antibiotic substances that have recently become important in disease control for man are produced by common soil organisms. Included in these are penicillin and streptomycin. In the soil such antagonistic relationships have been used to advantage by encouraging microflora antagonistic to particular diseases organisms. King *et al.* (1934) reported successful control of the cotton root fungus by heavy annual applications of organic manures. The manures stimulated a vigorous growth of normal soil microorganisms which depressed the activity of root not fungus.

"Blair (1943) has found that the activities of the disease organism *Rhizoctonia solani* are depressed by adding wheat straw to soil....

"Sanford (1846) has reviewed the literature indicating that crop rotation may be important in inhibiting disease organisms because of the effects of plant roots in encouraging the development of certain groups of organisms.....

"These studies of microbial population suggest that the growth of certain crops on rotation may not only discourage disease organisms by depriving them of a host plant, but may also actively oppose the organisms by encouraging microbial groups antagonistic to the disease causes."

The authors of this book certainly realize the importance of organic matter and Nature herself to the prevention of plant disease. Their attitude is summed up in the following sentence. "Of principal significance (to the prevention of plant disease) are crop rotation, maintenance of a high level of decomposable organic matter in soil, control of soil reaction and the maintenance of soil moisture, aeration and temperature at desirable levels for plant growth."

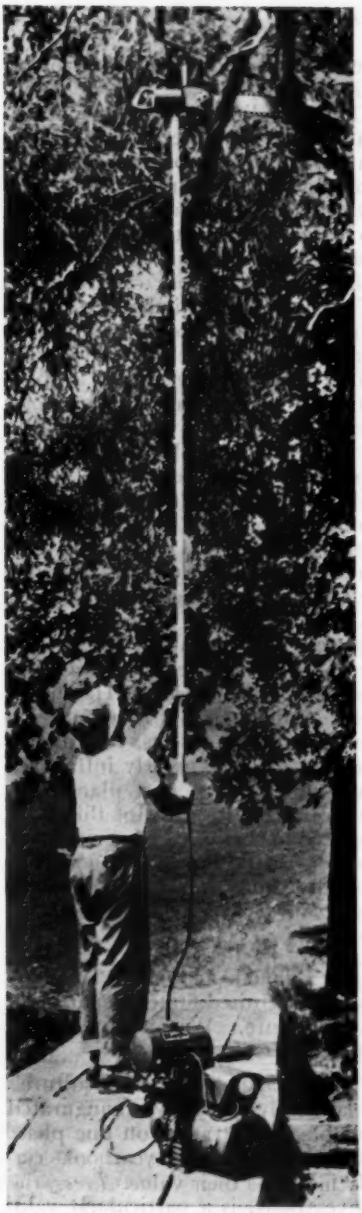
The feasibility of natural control of insects is also emphasized in *Irrigated Soils, Their Fertility and Management.* "The work of Hasenman (1946) and others," it is stated, "has pointed out that insects, like disease organisms, may be greatly influenced by the nutrition of host plants."

Of course, quite a bit of this book is devoted to chemicalized agriculture. However, the authors adopt a scientific attitude toward *all* types of agriculture and treat all theories equally.

TREES, THE YEARBOOK OF AGRICULTURE, 1949, United States Department of Agriculture, Washington, D.C., $2.00.

The Department of Agriculture's comparatively recently inaugurated policy of concentrating on one phase of agriculture in its yearbook certainly increases their value. *Trees*, the 1949 yearbook, is a particularly valuable book. The tree problems of both the city dweller and the plantation owner are treated fully. Its pages contain the answers to any tree lover's questions, except, perhaps, about the Organic Method.

The Market Place



A lightweight chain tree saw has been developed by the Mall Tool Co. The saw will cut 12 inch branches 15 feet above the ground, and will fell, buck and limb trees up to 24 inches in diameter.

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A new hydraulic remote-control unit for effortless control of trailing-type implements has been announced by International Harvester. Trailing implements can be raised and lowered with the touch of a lever.

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